TECHNOLOGY DEPT.

TECHNOLOGY REVIEW

February 1954

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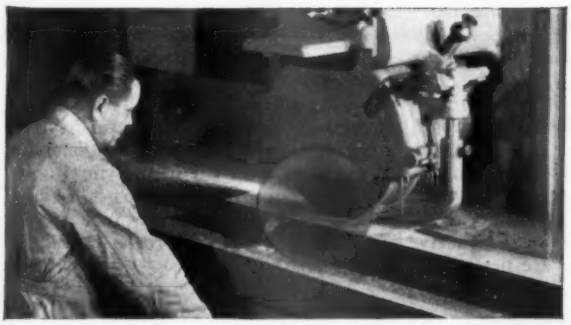

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What General Electric people are saying . . .

G. C. HOUSTON

Mr. Houston is Manager—Manufacturing Training Services Section, Manufacturing Personnel Development Services Department.

" . . . Leadership ability is not developed by attending lectures or by reading, even though such activities may be helpful in stimulating thinking and developing a higher degree of understanding. We believe, without qualification, that the only sound way to acquire and develop these abilities is through the process of learning by doing. Consequently, any well-conceived leadership development program is built around these principles . . .

Provide opportunities in the work situation to practice doing those things required of men in positions of leadership responsibility.

Associate with proved leaders.

Adequately evaluate performance and give sound guidance and counseling along the way.

Each of the individual's assignments in his work situation should be supervised by a man who has already proved his leadership ability, who is genuinely interested in developing others, and who is familiar with the objectives of the assignment in relation to the needs of the candidate. The assignment should be planned to provide experience which will not only increase the candidate's know-how, but which will also provide an opportunity to strengthen his weak points or further develop his specific abilities.

G. E. Review

P. R. HEINMILLER

Mr. Heinmiller is Managing Editor of the General Electric Review.

" . . . There is more writing in industry than turning out technical reports. There are letters and memorandums, reports and articles to associates in your field of engineering, and what is most difficult of all, presentations to management. I say 'most difficult of all' because you must get your ideas across to non-engineers, and you cannot take refuge in technical jargon.

When writing signed articles for technical publications, you must: know your audience, write so your audience can understand you, and keep everything in a logical sequence. Be complete and concise, use active verbs, mix short sentences with long ones to give a change of pace, and avoid clichés. Start with an outline and then fill it in.

All other things being equal, the engineer who is articulate, who is able to express himself orally and in writing in an understandable manner, will gain more prominence than one who cannot. (I prefer the word "prominence" to "success," because the latter has conflicting definitions and often carries a high price tag.)

at Case Institute of Technology, Cleveland

H. M. ROZENDAAL

Dr. Rozendaal is Manager—Biological Studies Section, General Electric Research Laboratory.

" . . . Engineers and physicists have contributed much to technics in medicine and biology. Many of their efforts have been in the field of medical physics or biophysics. They have led to the discovery or development of apparatus, such as electrocardiographs, x-ray machines, diathermy equipment, electron microscopes, analytical apparatus using ultraviolet and infrared light, to mention only a few. Drs. Whitney and Coolidge in our Laboratory have been pioneers in this field and their contributions are known to every physician.

And now atomic energy has seriously affected medical diagnosis, medical therapy and biological research. New apparatus is being introduced to medical personnel. New devices for more accurate measurements and localization of radioactive isotopes in the body are needed. In these and allied fields, the engineer, the medical man and the biologist have many interests in common. We must encourage these people to get together to explore problems of mutual interest. Such an approach will be of interest to the scientists but, much more important, it may result in developments of great benefit to our patients.

Institute of Radio Engineers, Syracuse, N. Y.

H. F. MILLER

Dr. Miller is Manager—Advance and Development Engineering Services Division

It is estimated that at present there are about 100-million acres of worn-out land in this country. Bringing this land back to productivity is one of the major tasks that must be undertaken.

This will require vast quantities of the nitrogen-, phosphorus-, and potash-type fertilizers. But apart from this, recent discoveries have shown that it is possible not only to alter the chemical composition of soil but also its physical composition —characteristics such as porosity, density, texture, and moisture retention. Small quantities of organic materials—the "soil conditioners" as they are called on the retail market—are capable of doing many of the things that only humus in the soil could formerly do.

In the next 25 years the need will also arise for other chemical additives needed for the soil to support the growth of the mold or the fungi now present in humus. There is conjecture that soil molds and bacteria play a great role in transferring nutrients from the soil to the roots of the growing plants. This is a chemical industry—not now in existence —that could be breath-taking in scope.

G.E. Review

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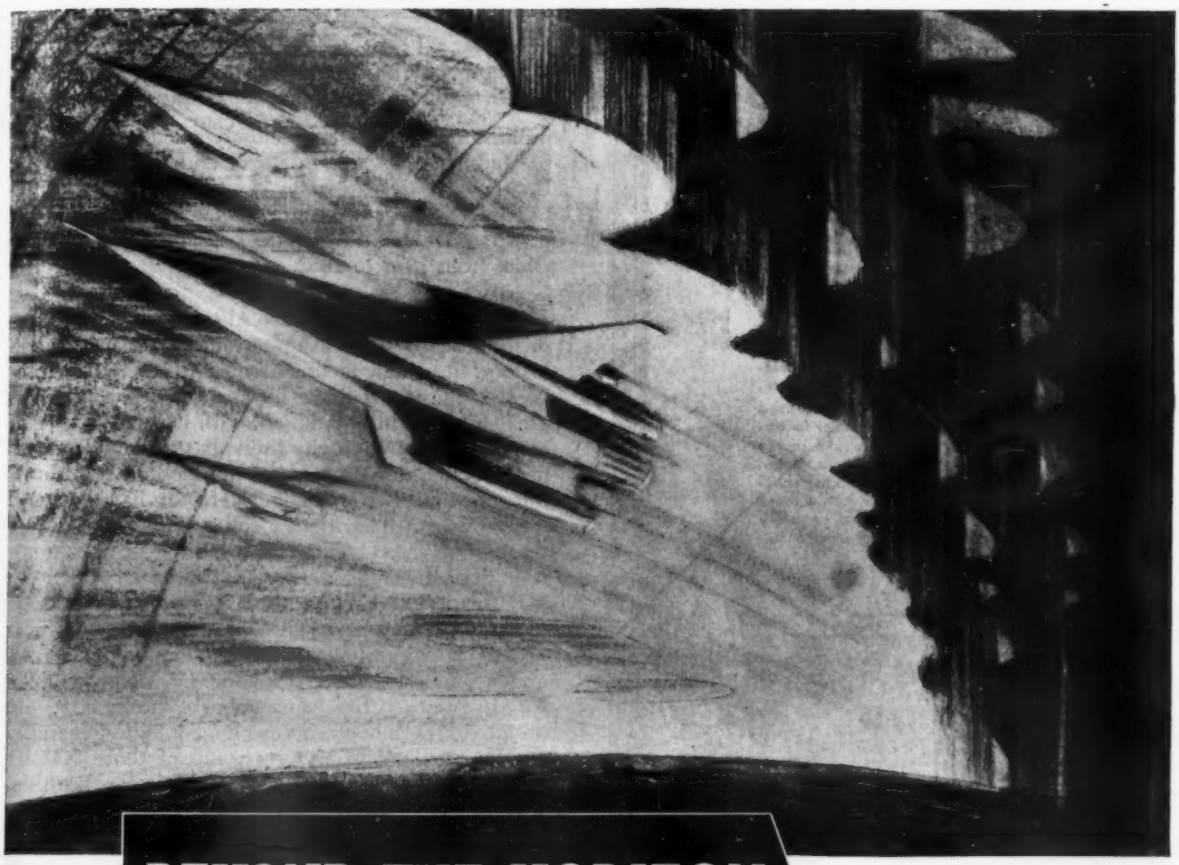
THE TABULAR VIEW

Summer Session. — PROFESSOR ERNEST H. HUNTRESS, '20, Director of the Summer Session, draws attention in this issue (page 191) to a fundamental change of emphasis in the summer activities of the Institute. His review of the origin and development of the Summer Session clearly demonstrates that the current viewpoint represents evolution, not revolution. With reference to the new accent upon Special Summer Programs for professional personnel from industry, government, and other educational and research institutions, the article cites new statistical evidence of the changing nature of the Institute's Summer Session. Dr. Huntress has directed this activity since February, 1952, coming to it after a long association with the Department of Chemistry, culminating in a decade as Professor of Organic Chemistry. He has also long been intimately concerned with the M.I.T. Graduate School through service for 10 years (1940–1950) as chairman of the Graduate Committee of the Department of Chemistry, for several years (March, 1950 – September, 1953) as Deputy Dean of the Graduate School, and currently as Secretary of the Graduate School. In addition to some five score professional papers representing experimental research, he is the author of four major technical books, and since 1947 has served as an associate editor of the Chemical Monograph Series of the American Chemical Society. He has been especially identified with the organization and systemization of chemical literature and has taken an active part in the development of the M.I.T. library system.

Tile Technology. — The second and concluding part of an article on "Decorative Tiles – Their Place in Ceramic Art" by E. STANLEY WIRES, '07, appears on page 195 of this issue. In the first part of this well-illustrated article (which appeared in the January, 1954, issue of The Review) Mr. Wires reminded us that much of the world's history, art, technology, and culture could be traced by fragments of tiles which we inherit from earlier civilizations. His article of last month surveyed the characteristic features of tiles from ancient Egypt, Babylonia, Assyria, Persia, Syria, Turkey, northern Africa, Spain, and medieval and Renaissance Europe. In the concluding installment, Mr. Wires traces the development of Dutch tiles, discusses English painted and printed tiles, and outlines the development of the tile industry in the United States from its origin in Philadelphia, Pa., and Bennington, Vt., about a century ago. He concludes with a few remarks regarding the Tile Club – an association of Nineteenth Century artists, painters, and sculptors, who used tile painting as an outlet for their creative talents. Illustrations for both portions of Mr. Wires's article are taken from the collections of American, British, and Continental European art museums, as well as from the extensive personal collection of tiles of Mr. Wires. The author is a graduate of the Institute's Course in Architecture and, throughout his

(*Concluded on page 178*)



BEYOND THE HORIZON....

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THE TABULAR VIEW

(Concluded from page 176)

professional life, has been closely associated with the tile industry. He was treasurer and manager of the E. Stanley Wires Company, Inc. of Boston from 1908 to 1944, and New England sales manager of the Cambridge Tile Manufacturing Company of Cincinnati, Ohio, from 1945 to 1952.

Challenge of Suburbia. — Although the basic lure of suburban living is as great today as at any time in history, three new factors account for the recent very great expansion in living beyond the urban rim. The great increase in population, with its high degree of centralization within city limits has provided greater need for the development of the modern suburb. At the same time, two technological factors have hastened the growth of Twentieth Century Suburbia. One of these is increased facilities and comfort of mass transportation; the other is the great advance which has been made in communication, according to KARL T. COMPTON, Chairman of the M.I.T. Corporation, whose article "Today's Challenge to the Family in Suburbia" appears on page 201 of this issue. Dr. Compton takes care to point out that, since suburbs are by no means all alike, it is difficult, if not impossible, to generalize on the problems of suburbia. But of those features which apparently contribute to this more healthful way of living, Dr. Compton singled out for special mention the fact that suburbs are of such size as to be capable of competent administration by civic minded individuals whose personal efforts can be helpful in directing community policies into productive channels. Perhaps such a conclusion might be expected from one who, although primarily known as physicist and university administrator, has performed outstanding services to his local community and, especially, to the nation. Dr. Compton's article is the result of a study conducted last summer and was delivered, in but slightly expanded form, at a conference in Scarsdale, N.Y., last October.

U. S. Industrial Chemicals, Inc. 8 Contracts

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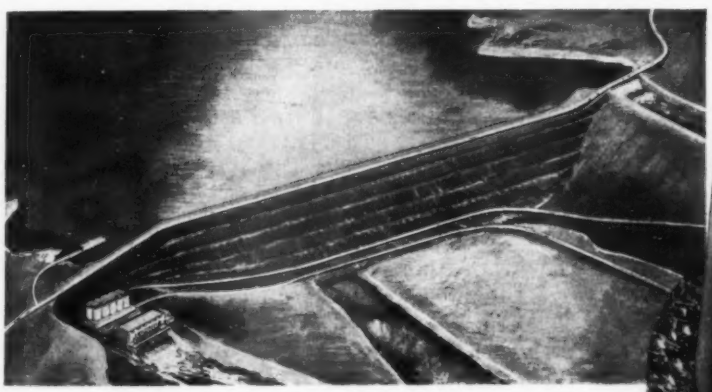

Habirshaw pipe-type power cable will provide a dependable and economical means of carrying this tremendous bulk of hydroelectric power at 230,000 volts, from the powerhouse to the outdoor switching stations at Garrison Dam, being constructed at Riverdale, N. D., by U. S. Army Corps of Engineers.

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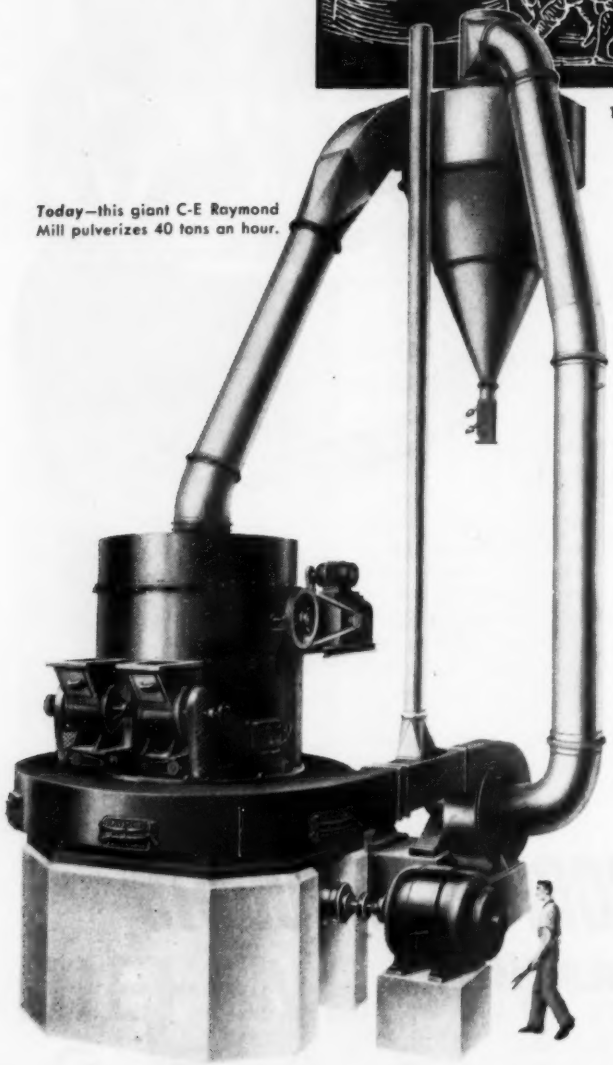

TODAY, literally thousands of the vital materials of everyday life depend on pulverizing: Plastics, for example—those magic resins whose uses seem nearly endless—as well as such diversified materials as minerals, coal, cocoa, pigments, sugar, limestone and face powder—to mention just a few.

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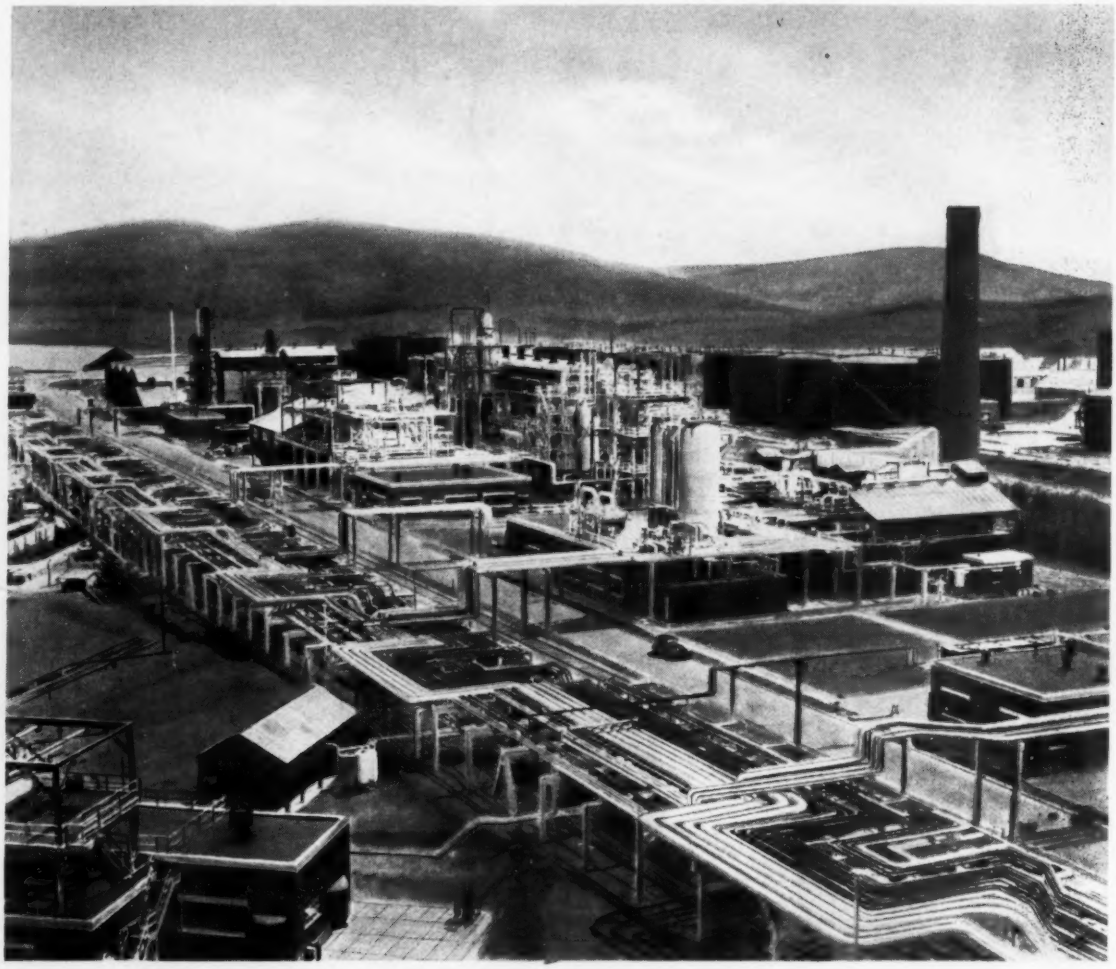

ON A HILLSIDE IN SOUTH WALES

Llandarcy, the Anglo-Iranian Oil Company refinery situated on a hillside near Neath, South Wales, has grown since 1946 from 360,000 tons to 4,000,000 tons capacity per year.

In this development program Badger Process Division of Stone & Webster Engineering Corporation, and its affiliate, E. B. Badger & Sons Limited, have played a major part.

Some of the new and modern facilities already completed or under construction are crude distillation, catalytic reforming, propane deasphalting, furfural extraction, solvent dewaxing, wax manufacturing and clay treating.

STONE & WEBSTER ENGINEERING CORPORATION

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"POT HOLDER"- Industrial Style

Photo Courtesy Wellman Engineering Co.

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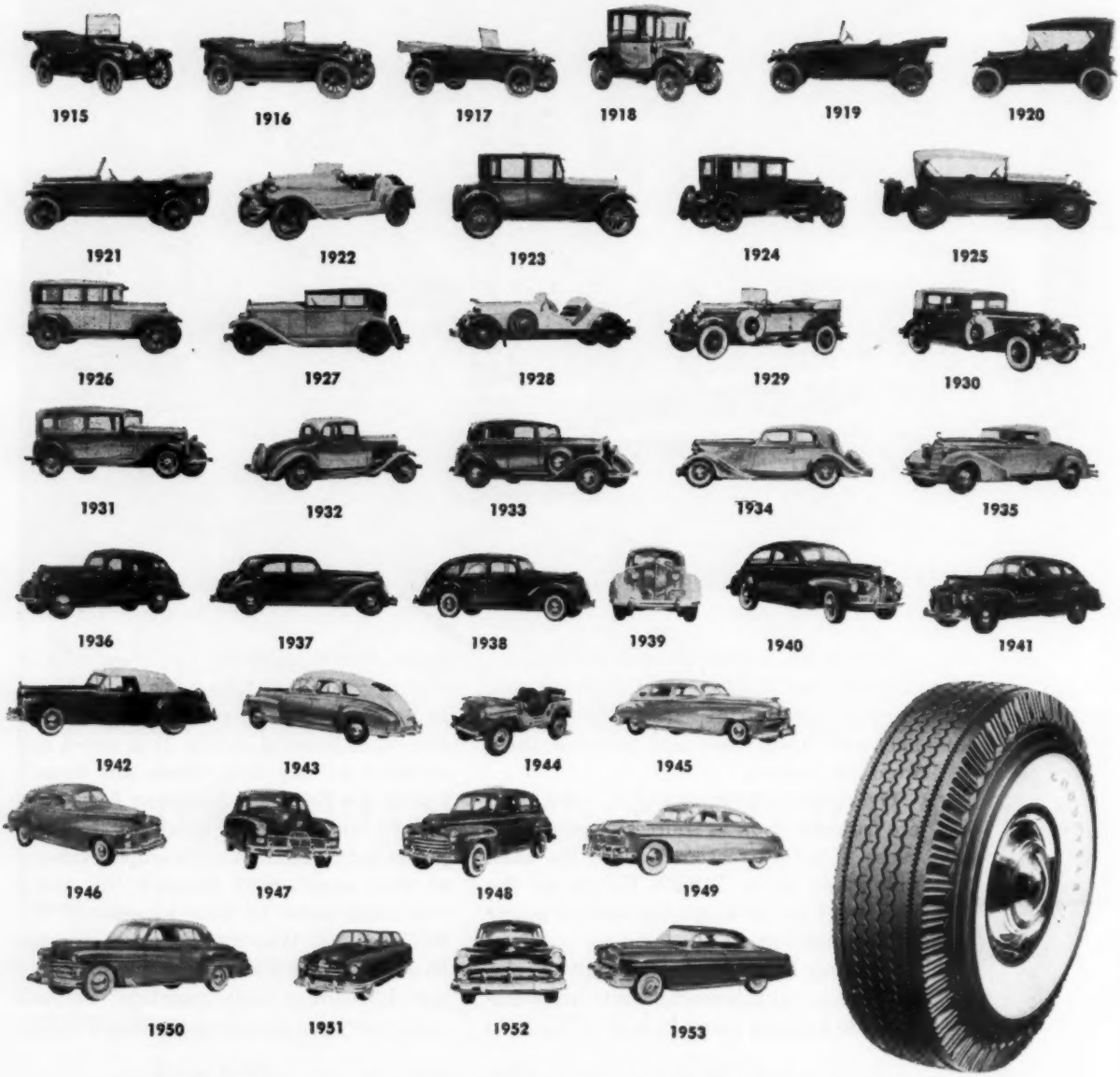

In 1954, too, as in every single year for the past 39 years

MORE PEOPLE RIDE ON GOODYEAR TIRES THAN ON ANY OTHER KIND

GOODYEAR

AKRON 16, OHIO

Japanese garden lantern (January Contents page) was made for 16th Century Japanese emperor. This lantern, largest of its kind, was presented to the City of Boston by a Japanese merchant.

Raymond E. Hanson

How Well Do You Know Boston?

Broken monument reading, "Boston 8 Miles, 1734" within a few feet of well traveled streetcar and bus lines in a business section of town, was witness to several important historical events. Do you know where this marker is? If not, see Contents page for March.

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Yarns

Symbolic of the textile industry is this photograph, by J. P. Wahlman of Chicago, which was displayed in a one-man show at the Institute's Photographic Salon.

THE
TECHNOLOGY
REVIEW

Vol. 56, No. 4

February, 1954

The Trend of Affairs

Science in High Schools

TWENTY-THREE prominent U.S. educators warn that the nation is critically near a breakdown in the first step of training scientists – high school science teaching. In view of the importance of science and scientists to the national economy and the national defense, they find the situation "not only insupportable but perilous." The warning is contained in a report, published in December, by educators who took part in the month-long Conference on Nationwide Problems of Science Teaching in the Secondary Schools, held last summer at the Harvard Graduate School of Education. In part, the report states:

In the scientific and technological culture of our present day society, every citizen needs a realistic understanding and appreciation of the part that science, both physical and biological, plays in everyday life. Of comparable importance are also the development of understandings and skills which function in a wide variety of occupations, and the identification and encouragement of scientific abilities needed in engineering, research, teaching, and other scientific professions. . . .

Surveys of the country's youth have found that the intellectual resources of the United States are not being exploited to anywhere near their full potential. Such a finding, at the onset of the "Atomic Age," should command the serious concern of educators, scientists, and industrialists alike.

The group found that the present shortage of science teachers may be expected to grow more acute in the next decade. Further, some of the people now teaching science are not qualified for the task. Comparison of supply and demand for high school science teachers over the past few years and projected changes in high school population during the next decade lead to alarming conclusions, the report states. Among these conclusions are:

1. By 1960 there will be 9,300,000 public school students in grades 9 to 12, an increase of 41 per cent over the current enrollment of 6,600,000 in those grades.

2. By 1965, high school enrollment will be between 11,000,000 and 12,000,000 – almost double the present figures.

3. There are now 67,000 science teachers in public secondary schools. The number required in 1960 will be 84,000 and by 1965 the need will rise to 100,000.

4. The annual number of college graduates has dropped from 430,000 in 1950 to 300,000 in 1953.

5. The annual number of college graduates qualified to teach high school science has declined from 9,096 in 1950 to 4,665 in 1953.

6. Already the annual need for new science teachers exceeds 7,000 and will soon approach 10,000 while at present a maximum of 5,000 potential replacements graduate from college.

Furthermore, the report points out that due to several factors, including more attractive offers from government and industry, many of the college graduates qualified to teach science do not enter the teaching profession.

"For want of a few thousand competent new science teachers each year, science instruction may necessarily be radically reduced in the schools," the report asserts. "Or the instruction offered may be such a caricature of science that promising students turn elsewhere."

The report urges that public attention be directed to the "physical dangers resulting when students are taught science by ill qualified teachers. If parents can be shown that an unqualified teacher may without proper precautions expose their children to the hazards of harmful chemicals, dangerous electrical devices, and improperly handled animals and infectious bacterial agents, these parents will influence school administrators to secure properly trained and certified science teachers."

Some of the inadequacies of science teaching arise from problems general to the whole field of public

education; among them, overwork and low pay. In 1938 teachers were in the top third of the income groups of the country, but only 10 years later they were in the bottom third.

What can be done to remedy this distressing situation? The report makes a number of recommendations aimed at raising the level of science teaching:

The critical condition of science teaching should be brought forcefully to public attention.

Colleges and universities should co-operate with scientific groups in a vigorous recruitment campaign for secondary school teachers, especially in science and mathematics.

High school teachers should encourage pupils to consider science teaching as a career.

School officials should explore the possibilities of rearranging curriculums and teaching assignments in order to utilize the talents of qualified science teachers to the utmost.

Efforts to improve teacher training should be continued and should stress a mastery of the field to be taught as well as contact with all major areas of knowledge. The prospective teacher should understand educational theory and the way in which children learn, and should develop skill and competence in teaching through realistic experience with school problems.

National or at least regional standards for teacher certification should be adopted and better methods sought for appraising teacher competence.

A five-year college training program for teachers should be made a mandatory minimum.

Finally, "the generally-desired ends of education will be approached as teaching becomes more nearly a profession. This is not a pious wish, but a mandatory condition for the improvement of teaching. Only then can we have the widespread *elan* which will lead to creative teaching, inspiring both to pupils and teachers. Only then will children in school get what is rightfully theirs. . . . When we consider how inevitably science affects our national economy and national defense, mediocrity in science teaching is not only insupportable, but perilous."

Privately Endowed Research

VANNEVAR BUSH, '16, President of the Carnegie Institution of Washington, emphasized the continuing importance of privately endowed institutions for progress in fundamental research, in his annual report to the trustees in December. According to Dr. Bush, "In the field of fundamental research, the research institution is paramount and is by no means an obsolescent form of organization. It can, if it will, carry on fundamental research in a most fruitful way, better on the whole than can be done anywhere else.

"It is sometimes maintained," says Dr. Bush, "that the day of the independent research institution is over, that henceforth fundamental research belongs to the universities with heavy governmental subsidy . . ." This view he believes is partly based on an assumption "that fundamental research and the education of brilliant students should be closely related and that the research institution is prone to become ingrowing and stodgy in the absence of the continual impact of young minds." But in his opinion the assumption is not well founded. For he holds that it is an error to regard formal education as the only means of contact with youth. A research institution can and must expose itself constantly to the influence of young minds. It can, in his opinion, select the cream, not only in mental capacity but in the subtle characteristic of being able to fit well into a scientific community. Once selected, its younger staff members can be made genuine participants in its program.

"It has long been realized," Dr. Bush observes, "that one of the most effective ways to ensure outstanding achievements in fundamental research is to locate the individual of genius and support him liberally as he pursues his own way." Although support of the individual of genius, who often times is a lone worker, has resulted in the accomplishment of great things in the past, Dr. Bush feels that much more has been and will be accomplished by "those who have brilliant creative skills combined with human attributes that make them always welcome in a community of their peers. . . . The independent research institution furnishes an ideal climate in which such individuals can function to best advantage.

"The principal condition . . . for ensuring the prosperity of research institutions is financial. It is, moreover, a matter of endowments rather than of current funds for projects," according to Dr. Bush, who adds:

"Since 1920, according to a recent report by C. I. Campbell, the fraction of the total national income devoted to research has been multiplied by 10. But the fraction devoted to fundamental research has increased relatively little. The federal government has entered strongly into support of research, but its entrance has brought a host of problems, and its support is largely confined to projects, some of them in basic research. These projects allow an organization such as a university to expand its operations. But they do not create new centers of research, nor do they allow old ones to proceed to a permanently secure basis.

"The great foundations have turned away from endowment grants, and the new foundations that are formed do not enter this field. . . . This change in the policy of foundations . . . adds to the great sums being spent on a project basis. And the temporary project is not a sound way in which to carry on fundamental studies of depth or subtlety.

"The project idea, introduced largely during the war and as a necessity at that time, is far better adapted to applied research than to fundamental research. This is part of the reason why fundamental research has not been expanded to the extent that it should be. . . . In general the foundations have not tackled the problem of extending fundamental scientific research in this country, nor is there any great indication that they will do so.

"New independent research institutions have been established by individual philanthropists. . . . Yet these have been largely directed as specific objectives, often in the medical field, and often of a semi-applied nature. This is not because men of wealth lack interest in search for the unknown . . . unencumbered by more immediate objectives. . . . It is rather that such men understand better the sufferings and needs of humanity and are anxious to alleviate them."

Quiet!

UPON return to a city from a week end spent in a quiet countryside, one is straightway shocked by the urban noise. The roar of a city – called by acoustical specialists the "noise background" – one soon becomes accustomed to. But punctuating the noise background are unexpected or particularly loud sounds that startle or annoy, and at night interrupt sleep. Recently a new noise nuisance has begun to keep city dwellers awake at night; the operating noises of apartment window air-conditioning units, plainly heard in nearby, non-air-conditioned dwellings when windows are opened wide on hot summer nights.

This country has indeed become noisier and noisier, especially in recent years. Although a few countermeasures have been taken, such as installation of sound-absorbing ceilings in some offices, factories, and restaurants, effectiveness of these measures has been far outrun by the growth of noise resulting from increasing industrialization, more automobiles, more (and noisier) airplanes, and similar technological changes.

Industrial noises sometimes reach sound intensity levels producing measurable damage to hearing. Although sound intensity levels less than 160 decibels will not permanently deafen through rupture of the eardrum, 100–120 decibels can cause temporary hearing loss and may exist in industrial situations. Recovery from transient hearing loss caused by noise is gradual, and may require as long as 24 hours. Hence a worker exposed to deafening noise may recover his full hearing acuity only briefly over week ends.

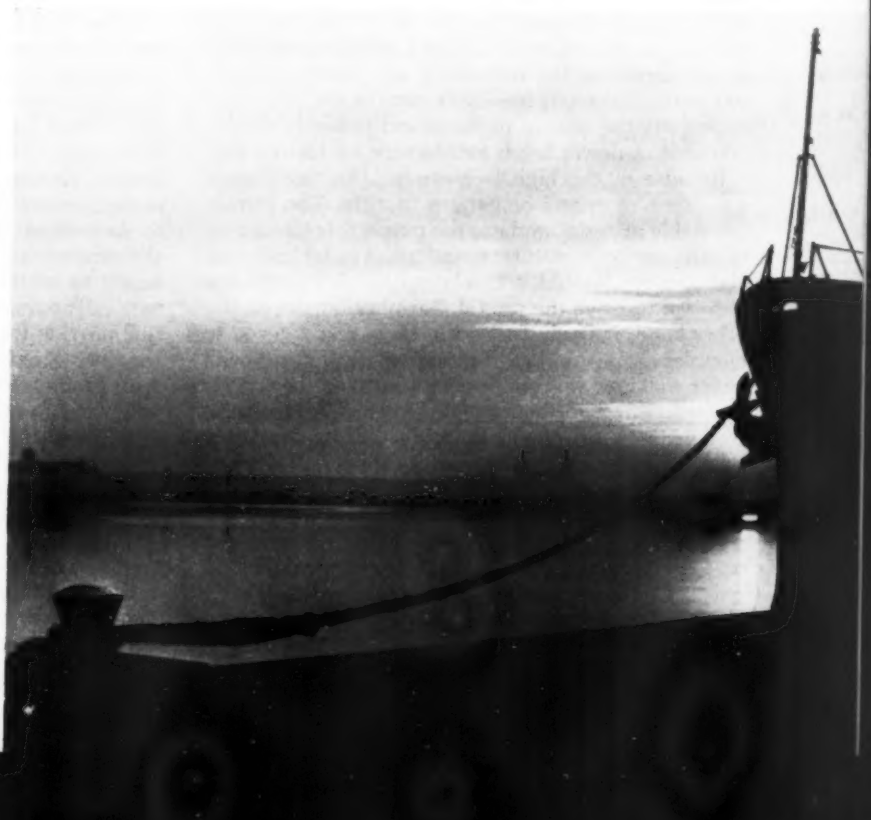
Noise injury to hearing may be measured objectively. Adverse psychological or psychosomatic effects of noise are hard to measure, but clearly can be serious. Thus no one will deny that nervous tension is generated by straining to hear, and to make oneself heard, above noise. Loss of sleep because of noise is manifestly a health hazard. Loud, unexpected sounds are known to affect the blood pressure and functioning of the digestive tract of human beings, apparently through a fear reaction. Subjective symptoms recounted by persons exposed to intense noises (as of ram-jet engines) include nausea, optical difficulties, fatigue, and headaches.

Noise, then, has profound effects upon the human being. Hence it is reassuring to know that the health hazards of noise are being given serious consideration. Standards for safe noise levels in homes, offices, and factories were proposed by one speaker at a recent meeting of the American Public Health Association. A simple, empirical method for quantifying noise was suggested by determining the distance at which spoken words may be understood by a person with normal hearing.

Efforts are also under way to attempt to establish standards for industrial noise through the agency of the American Standards Association. The data required for this purpose are not readily available. Indeed, a critical examination of the criteria previously proposed has demonstrated the necessity for obtaining very much more information on the relations between hearing loss and noise exposure than has been available in the past. Already a considerable amount of data has been collected on sound-pressure levels in the various frequency bands, and on the threshold of hearing for pure tones. Such data have been obtained for noise of different kinds, in a program of research in which M.I.T. is playing a significant role.

Not enough is yet known about such questions as: (1) What kind and amount of hearing loss constitutes a handicap? (2) How should noise be specified and exposures be measured? (3) In establishing standards

The camera of Lewis T. Reed, A.P.S.A., A.R.P.S., silhouettes this firmly secured nautical sentry as daybreak illumines Chicago. Apparent in the illustration is a tranquility the achievement of which may perhaps be attained when the health hazards of noise are given serious consideration, as discussed in the above article. This photograph by Mr. Reed was included in an exhibit held at the M.I.T. Photographic Salon.



on industrial noise, for what percentage of persons is protection feasible? It may not be possible to establish such criteria immediately. The ultimate goal, however, is the creation of an industrial environment which shall afford industrial workers reasonable protection against hearing loss, even though it may not be possible to achieve the desired degree of quiet.

Washing with Sound

FOR the cleaning of small precision parts the technique of washing with ultrasonic energy is currently attracting attention. Frequently, attempts to clean parts containing fine serrations, deep holes, crevices, and other small pockets by washing or manual brushing result in a high rate of rejects, for the fine particles of metal, dirt, and grease tend to cling stubbornly to their sanctuaries. But if the same parts are immersed in a solvent, or even in soapy water, and the liquid is then agitated at frequencies far above the audible range, cleaning can be extraordinarily thorough. Oil films, for example, are removed so completely that unless the solvent itself leaves a protective film, or one is promptly provided, iron or steel parts will rust rapidly.

This ultrasonic system has, as its basic components, an oscillator to provide a source of high-frequency electrical energy, an electromechanical transducer to convert the electromagnetic oscillations into mechanical motion, and a coupling network to convey electrical energy from the oscillator to the transducer. Vacuum tubes are employed as flexible and convenient methods of generating high-frequency energy to drive the piezo-electric transducer. Under the influence of such excitation, the transducer vibrates mechanically, and it is the mechanical vibration of the transducer, transmitted to the piece to be cleaned through a liquid, which is effective in cleansing.

Unlike the sonars used to detect objects underwater, these industrial washing applications require relatively high frequencies. Best results appear to be obtained in the region of 300 to 1,000 kilocycles, and energy inputs to the transducer are usually at least 400 watts. Ingenious feed-back circuits are employed to simplify the control problem and to assure the attainment of power levels satisfactory for factory use.

Because of the high frequencies, the transducers are either of quartz or barium titanate. The former is a stable material, and, for the purpose, is insensitive to ordinary temperature variations. Available shapes and sizes are limited, and relatively high voltages are required to drive the crystal. Barium titanate, on the other hand, is easily formed in large pieces, even to complex shapes, and can be made to oscillate at much lower voltages. Barium titanate obtains its orderly crystalline array by being cooled from a high temperature while in a strong electrical field. If working temperatures exceed its Curie point (about 120 degrees C.) it is likely to lose its properties as a transducer.

In addition to possessing tremendous emulsifying action, ultrasonic energy of these high frequencies appears to owe part of its cleaning power to the physical dislodging of dirt particles by violently buffeting them loose. Dirt can be dispersed from otherwise inaccessible crevices if they face the transducer or a suitable reflecting surface. Parts are also cleaned quickly; an electric shaving head, for example, is completely cleaned when given a 10-second immersion in the sound beam. Ultrasonic energy apparently accelerates the cleaning action of typical degreasing solvents and alkaline solutions by factors of 10 to 100.

Among the types of products being cleaned by this method are miniature ball bearings (which can be ruined by a speck of dirt or even a perspiration-wetted fingerprint in the wrong place), deep holes in jet-engine parts and in hydraulic servo-components, potentiometer windings, vacuum-tube elements, and other small parts for the electrical equipment industry.

Plasma Electron Oscillations

IT has been a well-known fact for the past 20 years that electrons passing through the plasma of a low pressure gas discharge cause high-frequency oscillations. The phenomenon has been extensively studied by many workers, not only because of the interest in the physics of the process but also because similar oscillations may occur in the ionospheric and cosmic realms. Moreover, practical application of the phenomenon is made in tubes which generate microwave power.

In the brief space available here, it is not possible to present an adequate explanation of the underlying physics of the problem. Nevertheless, it can be demonstrated that free electrons and free space behave, respectively, like the inductance and capacitance of an electric circuit. The lagging current of an inductance and the leading current of a capacitor exactly cancel one another at a particular frequency called the resonant frequency. For electrons moving in space, there is a relation between frequency and electron density at which the conduction and displacement current exactly balance; the frequency at which this phenomenon occurs is called plasma resonance.

It has long been hoped that a controllable method could be found to excite the resonance oscillation as is done by vacuum tubes in resonant circuits. There has been a theory that plasma oscillations are excited by shooting fast electrons into a plasma, and Duncan H. Looney, '53, research assistant, working with Sanborn C. Brown, 10–44, Associate Professor of Physics, in the Research Laboratory of Electronics, undertook to investigate this mechanism. They discovered that the presence of the electron beam alone was not sufficient to excite observable oscillations. A feed-back mechanism was also required, which the plasma itself will provide if given the opportunity to do so by the presence of suitable boundaries. Under proper conditions, some electrons in the beam are accelerated, whereas others are retarded. By this action an otherwise steady electron stream is modulated by the bunching of electrons. Similar bunching occurs in klystron tubes which have been developed as effective microwave generators.

The feed-back mechanism of the oscillation was found to be standing waves in the plasma which could take on different resonance patterns much like the standing waves in an organ pipe, but they do not appear to obey any previously known laws.

M.I.T. Photo

The Charles Hayden Memorial Library, whose internal court is pictured above, provides commodious, comfortable opportunity for summer study. The building is air conditioned throughout, including the luxurious and restful Music Room, the west portico of which is shown in the picture. An unusually fine collection of recorded music, together with high-fidelity reproduction, is available for the enjoyment of Institute summer guests.

The M.I.T. Summer Session

New Perspectives and Fresh Horizons Are Developed Which Benefit Industry and Education Alike

By ERNEST H. HUNTRESS

THE rapid acceleration in the rate of development of technological and scientific knowledge is characteristic of the present era. The fruitful results of this speed-up are evident in every aspect of daily life. Although appalled individuals still occasionally call for a moratorium, the whole history of civilization demonstrates that progress will neither be halted nor decelerated by arbitrary edict. Accepting, therefore, the valuable lesson taught by history, and recognizing the ever increasing interdependence of technology and higher education, the traditional ivory towers and cloistered halls must give way to environments more appropriate to the solution of modern problems. Cognizant not only of the necessity for closer collaboration between technical education and industry, but also of the unusual opportunity afforded by its professional and geographical circumstances, M.I.T. has in recent years been shifting the accent of its summer activities to greater emphasis upon adult education. Through series of short intensive courses of instruction on timely technical topics and by means of professional conferences in particular fields, it has made available, in a form which permits busy industrialists to participate, means of keeping up with recent advances in their technical areas. This new approach to adult education, initially conceived as an experiment, has now so fully demonstrated its merit that the following report is presented of the evolution and present status of the M.I.T. Summer Session.

Evolution of the Summer Session

Subsequent to the initial conception of M.I.T. by William Barton Rogers in 1859, the period of development of these hopes culminating in the charter of April 10, 1861, and the first preliminary session of February 20, 1865, with 15 students, regular courses

of instruction began on October 2, 1865. Although M.I.T.'s first annual catalogue was therefore issued for the academic year 1865-1866, more than three decades elapsed before the first formal mention of summer courses appeared in the 34th annual catalogue issued for the year 1898-1899. Here it is first recorded (pages 59-60) that "During the summer vacation . . . a considerable range of studies is given in the lecture rooms and laboratories of the Institute by members of the instruction staff. . . . The work offered is planned with particular reference to subsequent study at the Institute. . . ."

Over approximately the next four decades utilization of the summer period between regular academic years became a generally recognized Institute activity. The number of individual subjects offered within the Institute's buildings gradually expanded into various professional summer schools, such as those of Civil Engineering, Chemistry, Mining and Metallurgy, Industrial Chemistry, and Geology, Paleontology, and Mineralogy. Under the pressure of rapidly expanding professional advances, the limitations of the regular academic year were ruptured by the transfer of certain subjects (such as Qualitative Chemical Analysis) to required M.I.T. summer schools. In other fields the nature of particular professional interests led to the establishment of centers of study at locations outside of the Boston area. For example, the Summer School of Civil Engineering, after various sessions at several different places, became until the present year firmly established at Gardner Lake, East Machias, Maine; the Summer Schools of Mining and of Metallurgy were held in alternate summers at far-flung locations in the United States and Canada; for more than a decade, beginning in 1902, a traveling Summer School of Industrial Chemistry was operated by the Departments of Chemistry and Chemical Engineering; field work in geology and mineralogy led gradually to the present M.I.T.-Nova Scotia Centre for Geological Sciences which is located at Antigonish, Nova Scotia.

Concurrently with the growth of the above extra-territorial aspects of the M.I.T. summer activities over the 40 years between the Spanish-American War and World War II, the number and variety of regular courses of instruction offered during the summer period constantly increased, both in the old location in Boston and subsequently in the new buildings at Cambridge. Owing, no doubt, to the (then) relatively rigid curriculums of the various professional courses, the desirability of summer study was accented primarily with respect to its service in making up deficiencies prior to formal admission, in effecting economies of time by anticipation of particular subjects, to removing conditions and failures incurred during the regular sessions, and to broadening the scope of professional training by study not normally included in a particular curriculum. Eventually, the necessity for specialized technical training for officers of the U. S. military services and the increased participation in such activity by the Institute, as a part of its responsibility to the national defense, introduced an additional incentive for summer instruction. Meanwhile the rapid growth and formal recognition of the Graduate School, accompanied by a corresponding increase in year-round prosecution of intensive research, resulted in more attention to, and heavier emphasis upon, the advance of knowledge through summer study.

The gradual change of emphasis of M.I.T. summer activity suggested in the preceding outline naturally resulted in the presence on the campus during the summer of an ever-growing proportion of the Institute staff, especially with respect to those members whose normal professional preoccupation was primarily related to advanced aspects of the various professional fields. Particular groups of these technical experts inevitably gathered about them from time to time other national and international specialists for periods of discussion and professional stocktaking. As such informal assemblies recognized the mutual benefit of these associations in a place where engineering and scientific advances were cur-

Privileges of the M.I.T. Sailing Pavilion are fully available to registrants in M.I.T. Special Summer Programs and Conferences. Its location on the Charles River Basin directly in front of Walker Memorial permits easy access, and facilitates such recreational activity between morning and afternoon sessions as well as at other times. Above the right-hand end of the float may be seen the top of the Sloan Building where some of the Special Program sessions are scheduled.

M.I.T. Photo

rently in progress, where special and sometimes unique research facilities were available, and at a time when the usual academic commitments of the group members were less insistent, many Institute departments seized the opportunity to sponsor professional conferences. As knowledge of the value and inspiration of such gatherings became widely disseminated, industry began to express an insistent desire for its personnel to attend and to participate. Such interchange of viewpoint and experience between representatives, both of theory and practice, of course proved stimulating to both. With the opportunities made possible by substantial increase of the Institute's housing and dormitory system, such specialized conferences and symposia became increasingly more frequent, notably valuable, readily operated, and widely recognized.

Following the close of World War II, recognition of the potential of the M.I.T. Summer Session, considered in the light of the evolutionary trends already summarized, led James R. Killian, Jr., '26, President of the Institute, to envisage an increase in tempo and scope of summer activities which would not only enhance the Institute's prestige and educational service, but would simultaneously permit more effective utilization of staff and general facilities. As the first step in the implementation of this challenge, Walter H. Gale, '29, Associate Professor of Aeronautical Engineering, made in 1949 an extensive survey of summer activities at 43 other colleges, universities and technical schools, together with an analysis of current experience at M.I.T. This resulted in recommendations regarding the nature, scope, organization, and policy for subsequent procedure at the Institute. This evaluation represented the most significant milestone in M.I.T. Summer Session history since the initial establishment of summer study in 1898, and resulted in a complete reformulation of objectives, policies, and administration.

Present Form of the M.I.T. Summer Session

As a direct result of the survey and recommendations of the Gale Report, there was established in September, 1949, as a new component of the general Institute administration an Office of the Summer Session headed by Professor Gale as the first Director. The over-all objective of the Summer Session Office was announced by President Killian as twofold, namely: "to utilize the facilities of the Institute during the summer months to the advantage of industrial, technological and scientific people who cannot participate in our year-round academic program, and to provide parts of the regular academic program for members of our student body who wish to remain for study in Cambridge during the summer." For the imaginative and constructive implementation of this twofold objective into the framework of its present form and for the initiation of many of the fundamentals of its present policies and practice, the Institute is indebted to Professor Gale, who served as the first Director of the Summer Session until on May 1, 1951, he became Secretary of the Institute. From May 1, 1951, to February 1, 1952, when he withdrew to assume new responsibilities as Associate Dean of Students, the Director of the Summer Session was Professor Frederick G. Fassett, Jr. The third and present Director is the author of this paper.

Before examining briefly some characteristics of the present form of Summer Session which have never before been presented, a brief summary of its framework may be helpful. In accordance with the pattern whose gradual evolution was suggested in earlier paragraphs, the M.I.T. Summer Session currently comprises three different types of activities, namely: (1) Special Summer Programs; (2) Professional Conferences and Symposia; and (3) certain regular M.I.T. subjects. Since the reformulation in 1949 of the Institute's objectives and opportunities regarding its summer activities, the relative emphasis upon these three aspects has been changing in the direction of accent upon adult professional and technical education of personnel from industry, government, and other educational and research institutions. Thus the number of Special Events has continuously increased and the number of regular M.I.T. subjects diminished as indicated in the following summary.

	1950	*1951*	*1952*	*1953*	*1954* (Est.)
Special Summer Programs	9	18	22	26	34
Conferences and Symposia	7	6	8	5	6
Total Special Events	16	24	30	31	40
Regular M.I.T. Subjects	233	235	232	179	110

Special Summer Programs

The Special Summer Programs comprise a group of short intensive subjects, especially designed for their particular audience. Although the majority of them are of two-week duration with exercises all day Monday through Friday, inclusive, some are given as one-week units, and a few cover three or even four weeks. Some combinations of successive single-week units also comprise a total duration of several weeks, but the nature of the programs is such that it is not possible to take more than one at a time. Most programs comprise both lectures and laboratory demonstrations (or practice) and are often supplemented by field trips to local installations of special professional interest. Each individual program is under the direct and active supervision of some member of the Institute Faculty, and is operated with the assistance of other members of the Institute staff. Almost all programs also utilize for particular topics numerous distinguished special lecturers drawn from outside the Institute staff. Because academic credit is not offered, the content of the various programs is flexible and the subject matter can be, and is, varied to afford emphasis upon topics of special interest to a particular group. No examinations are required, nor are grades given, but a formal certificate of attendance is issued to all registrants. Since each program brings together a group of persons with a large common area of specialized interest, but of wide geographical and professional distribution, each registrant is provided at the first meeting of his group with a roster giving sufficient biographical and professional detail to form a basis for quick establishment of new professional contacts. Moreover, so far as circumstances permit, registrants for a particular program are housed in

M.I.T. Photo

The Alumni Swimming Pool, located on the East Campus directly north of the Charles Hayden Memorial Library, has always been exceptionally popular with all members of Special Summer Programs and Conferences. Like the Sailing Pavilion, its extremely convenient location facilitates easy access without loss of time. Just outside the Gargantuan southern window shown in the picture is a large walled garden and sun-bathing area. The pool schedule during the summer provides not only for men, but includes certain periods reserved for women, as well as other periods for mixed swimming.

adjacent quarters to promote development of new acquaintances with similar interests. These and other devices to promote cordial human and professional relationships have been most appreciatively received by program participants.

In an effort to emphasize the general attractiveness of the cultural and recreational resources of the Metropolitan Boston and general New England area as ancillary to the direct professional appeal of the technical matter of the various Special Summer Programs, registrants are encouraged to arrange their attendance in connection with vacations in this area. Special housing rates in the dormitories are extended to married couples, and assistance in the location of other housing for couples with families is extended as part of the Summer Session Office service. A special individual letter of welcome is sent out to wives whose husbands have been admitted to Special Programs and various special courtesies are extended to them during their period of residence.

Conferences and Symposia

Summer Conferences and Symposia differ from Special Summer Programs only in degree. They are generally much shorter, usually of one, two, or three-days' duration. Unlike the Special Summer Programs, no tuition is charged, but only a nominal registration fee. Housing in the M.I.T. dormitory system is offered at the same rate as for Special Programs. The actual sessions of a typical conference are operated by departmental representatives and usually comprise many speakers from outside the Institute, but over-all administration, including publicity, preregistration, housing arrangements, and financial accounting, is handled by the Summer Session Office.

Regular M.I.T. Subjects

As is evident from the tabular comparison of the number of special events with the number of regular M.I.T. subjects offered in recent years, the latter aspect is somewhat restricted. The apparent curtailment should be recognized, however, as in the interest of more efficient operation of those subjects which are retained as summer offerings. Rather than spread the staff thinly over a wide variety of departmental subjects in many of which only a very few students desire summer registration, emphasis is given to a limited number of subjects selected with special reference to their value and relationship to substantial student groups. Both undergraduate and graduate thesis research is carried on in the summer by all departments in constantly increasing volume. Fundamental subjects, particularly of the first and second years, continue to be available. Elimination of subjects which experience has shown to be in slight demand during the summer has thus permitted increased staff attention to those subjects retained, to research or creative writing, and to other forms of professional or departmental development. By appropriate equilibration of the three components of current Summer Sessions, namely, the Special Summer Programs, Conferences and Symposia, and regular M.I.T. subjects, it is believed that the staff generally will derive stimulation and inspiration from increased variety and diversification of interest.

Some Facts Regarding Special Summer Program Registrants

As a result of several years' experience with the threefold nature of current Summer Session practice, and particularly since its growth in 1953 affords a substantial and representative sample of size sufficient to permit significant inferences, certain hitherto unpublished facts with regard to Special Summer Program registrants may be of general interest.

During the Summer Session of 1953 there were carried on 26 different Special Summer Programs. These originated and were executed by 10 different Institute Departments as follows: Aeronautical Engineering, 1; Architecture and City Planning, 1; Chemistry, 4; Food Technology, 1; Electrical Engineering, 4; Industrial Management, 1; Mathematics, 1; Mechanical Engineering, 10; Metallurgy, 1; and Physics, 2.

These attracted to the Institute a total of 1,354 registrants, or approximately 12 times as many as the first such series five years ago in 1949. (It must be understood that this figure is independent of, and in addition to, 1,678 M.I.T. students registered as such during the summer.) In addition, 197 other persons actually admitted to Special Summer Programs subsequently found that changed personal plans compelled their withdrawal before arrival in Cambridge, while

(*Continued on page 218*)

Decorative Tiles

THEIR PLACE IN CERAMIC ART — PART II

Just a Century Old, the American Tile Industry Traces Its Origins to Dutch and English Art and Ceramic Practice

By E. STANLEY WIRES

In the town of Gubbio, in the hills of Italy, there is a legend about the potter, Giogio Andreoli. When a child of his was stricken with the plague, he vowed that if God would spare his child's life he would produce a color on majolica, which by its fame would bring a large increase in income that he would devote to the holy church. The child recovered, and, true to his word, Andreoli cast his treasures of pure gold into the melting pot. The famous ruby-colored majolica was the result. Little did he realize that majolica was to be the prototype of Delft earthenware.

Dutch Tiles

After the Treaty of Breda, in 1609, which ended the war between Spain and the Netherlands, Dutch craftsmen traveled to Italy and Spain and had every opportunity to learn the art of the majolica potters. At this same time East India merchants were bringing Chinese porcelain to Europe and it was not surprising that the Dutch potters became excited about this mysterious translucent ware. Lacking the fine kaolin clay of porcelain, they substituted a cream-colored body, coated with a white tin glaze, decorated in pure blue or polychrome colors.

Museum Van Oudheden, Rotterdam

Fig. 15. This wall tile picture entitled "The House of the Thousand Terrors," is one of the most important Dutch panels of allegorical design of the Sixteenth Century.

Potters from Antwerp founded factories in many Dutch cities, the most important being Delft, a walled and moated city, then used as the home of nobility. The vital struggle with Spain had sharpened the wits of the Dutch people, and with added wealth and trade with the East they were ready to support the work of the potter. Many of the tile picture painters

Museum Van Oudheden, Rotterdam

Fig. 16. A wide range of subjects, including fruit, animals, and floral scenes, such as this vase of flowers, were characteristic of the Seventeenth Century Dutch tiles.

Fig. 17. The Seventeenth and Eighteenth Century Dutch tiles at left are samples of the periods. Designs of ships, sea monsters, and landscapes were influenced by Dutch painting and engraving.

E. Stanley Wires

were held in almost equal esteem to that of the great Dutch painters.

At first, tiles and pottery were made in the same factories, but as time went on there were factories for the manufacture of tiles only. Less care was taken in their production and the master painter gradually gave way to the artisan.

About 1584, a potter named Herman Pietersz married Anna Cornelisz of Delft. Later his name appears as the first member of the Guild of St. Luke. This Guild was originally made up of about 700 members and eight crafts – stainers of glass, engravers, potters, weavers of tapestries, sculptors and carvers, scabbard makers, art printers and booksellers, and dealers in painting and engravings. Members had to serve an apprenticeship of six years and were required to pass a rigid examination. The Guild reached its climax in about 1680, when, out of the Delft population of not more than 24,000, there were 2,000 workers in the 30 potteries. No modern labor union was ever more exacting of its members or more indifferent to the rights of others than was this Guild. The unauthorized setting of a pane of glass made the owner of the house liable to a fine of 12 florins.

The earliest floor tiles of the Fifteenth Century were about seven-eighths of an inch thick, made of a red clay, with overglaze of lead. The transition from lead-glazed floor tiles to tin-enameled wall tiles of the Sixteenth Century must have been a rather gradual process. Enough patterns have been found of the early enameled tiles to substantiate the influence of Italian and Spanish technique, possibly through Flemish channels.

Characteristic of the Seventeenth Century tiles were designs of oranges, split pomegranates, tulips, grapes, and even vases of flowers and dishes of fruit, such as are illustrated in Fig. 16. Importance was given to the corner motives but as time went on the stylized fleur-de-lis of some designs dwindled to tiny rosettes. Designs of ships, sea monsters, landscapes, horsemen, and royal portraits show the influence of Dutch painting and engraving, as will be noted in Fig. 17. The one exception was the primitive attempt to depict Biblical scenes, often conceived in the mind of the tile painter.

In addition to the single tiles, we find beautiful tile pictures both in the Netherlands and in Belgium. As illustrated in Fig. 15, these show flowers, fantastic birds, and allegorical subjects painted by such well-known artists as Cornelius Boumeester and members of the Aelmis family. One of the most important panels of allegorical design (Fig. 15) was called the House of the Thousand Terrors, and depicted a lamb standing in the midst of four snarling wild beasts.

Dutch tiles were shaped by pressing the buff clay into a square mold, with pegs protruding at the corners to hold the tile in place while its edges were trimmed. The thickness of the tiles varied from five-eighths of an inch to one-quarter of an inch in the later tiles of the Eighteenth Century. Pinpricked de-

E. Stanley Wires

Fig. 18. Early in the Eighteenth Century, tilemaking became one of the principal trades of Bristol and Liverpool, England. Samples of these tiles, Twentieth Century French painted tiles by George Martel, and Nineteenth Century English printed tiles depicting Charles Dickens' characters are shown above.

signs on paper were laid over the tiles and sprinkled with powdered charcoal to form what was called a "ghost" to be filled in by the painter.

Tiles were installed as wainscots, chimney pieces, and wall murals. In the homes of the wealthy, it was customary to have a room expressly set apart for the show of Delftware. This room represented both kitchen and dining hall; a tile stove, walls covered with tile, shelves full of dishes, a table set for dinner with a service of every possible article.

It is interesting to note the variety of names taken by the tile factories – the Three Bells, the Porcelain Hatchet, the Golden Flower Pot, the Water Can, the Peacock, and the Double Pitcher. The celebrated Three Bells, the last of these factories, was sold in 1850, when Delftware had become steadily degraded and fine European ware had replaced it.

English Painted and Printed Tiles

During the years that elapsed between the cessation of the Fifteenth Century medieval tilework (described in Part I of this article) and the Seventeenth Century revival of decorative tilework in England, there is very little information connecting these two centuries of ceramic history. It seems plausible to attribute the Seventeenth Century revival to the great popularity of Delftware in England and the impetus it gave the industry.

GEORGE STEPHENSON'S LOCOMOTIVE THE ROCKET
1829 ABOUT 8 TONS, ABOUT 18 FEET LONG
SIX HORSE POWER, SPEED 24 MILES.
THE MODERN AMERICAN COMPOUND LOCOMOTIVE
97 TONS 70 FEET LONG 1500 H.P. SPEED 70 MILES
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
E. Stanley Wires
U. S. FRIGATE "CONSTITUTION"
Launched 1797. 2200 tons displacement.
Length of Hull 201ft. Mainmast 224ft.high.
Cost $302,719-00. Rated 44 guns, carried 55.
Crew 500 Officers and Men.
U. S. BATTLESHIP "FLORIDA"
Launched 1910. 23033 tons displacement.
521ft. over all. Fire control towers 145 ft.high.
Estimated cost $6,000,000.
Crew 60 Officers, 954 Men.

Fig. 19. In the United States, the Jones, McDuffee and Stratton Corporation issued annually, from 1881 to 1929, a Wedgwood tile calendar (above, left, and right). One of these, dated 1916, showed the M.I.T. buildings in Cambridge (center).

Dutch craftsmen had come to England in the late Sixteenth Century, but it was not until about 1690 that the old peasant industry was revitalized a century later, upon the arrival of the Dutch brothers John and David Elers. They were of noble family and their father had served as ambassador to several courts of Europe. Their pottery was at Bradwell Wood, a lonely spot in Staffordshire, where they discovered clay of superior quality. It is said that they attempted to preserve the secret of their formulas by employing stupid and ignorant workmen. Their precautions were of little avail, for a potter, Astbury of Burslem, feigned idiocy, obtained employment, and stayed until he had mastered all of their secrets.

Although the Elers brothers were largely instrumental in developing English Delft it is an interesting fact that the oldest specimen of blue painted ware made at Delft was signed by an Englishman – Tome Jansz, a Dutch spelling for Tom Jones. Early in the Eighteenth Century, the manufacture of tiles and pottery became one of the principal trades of Liverpool, Bristol, and Lambeth. Tiles for fireplaces were exported in quantity, and large panels of painted tiles, as shown in Fig. 18, were made for home decoration and house signs.

Thomas Shaw, Richard Chaffers, and Zachariah Barnes were well-known names, but it was John Sadler, an engraver, who invented the idea of transferring prints made from copper plates on tiles and pottery. Sadler got his idea from watching children apply waste prints to pieces of broken earthenware and, once the technique was perfected, it was applied to the printing of many five-inch-square tiles. John Sadler's association with Josiah Wedgwood came about through the fact that they both had perfected processes destined to bring pleasure to the common people, and by 1761 Sadler undertook the work of decorating Wedgwood's creamware. At that time he admitted the printer, Guy Green, to partnership.

The printing of tiles was divided into four periods: the Woodcuts, 1756-1757; the Sadler period, 1757-1761; the Sadler and Green period, 1761-1770; and the Green period, 1770-1789. Most of the tiles were printed in black and red, but purple, green, and blue were used to a limited degree. About 250 designs have been recorded, and, of these, 20 were signed by Sadler. The subjects cover scenes of gallantry, satire, sports, landscapes, fables, and two series of actors and actresses portrayed in their principal stage roles. One of these series, including about 40 subjects, was printed in 1780 by Richard Abbey, formerly apprenticed to Sadler and Green.

As to the source of the prints from which the copper engravings were made, the author is indebted to his friend G. E. Bryant of London for the following information: – The early woodcuts are after J. E. Nilson, an Augsburg engraver; the Chinese subjects are after Jean Pillemont (1759); the Aesop's Fables are after Barlow and Croxall (1722); the theatrical tiles are from Bell's Theatre (1776-1778); and various other subjects are from prints by Charles Mosley (1750) and Major and Paul Ferg (1754).

The Liverpool tiles were shipped in large quantities to the American colonies and were used as fireplace facings in colonial homes of the pre-Revolutionary era. Examples of such work may be seen in the Henry Wadsworth Longfellow House in Cambridge, Mass., the Jeremiah Lee House in Marblehead, Mass., and in the Isaac Royall House in Medford, Mass. Tiles in the Old Boston State House, taken from the residence of Governor Hutchinson, are also Liverpool tiles.

The demand for English tiles was so great that noted potters, such as Thomas Whieldon, made landscape and figured tiles by the salt-glaze process, and even Josiah Wedgwood, in the late Eighteenth Century, executed painted tiles for dairies and summer houses, much in fashion at the time. Mrs. Charles P. Gorely, an authority on the life and work of Josiah Wedgwood, has given the writer data from a letter written by Wedgwood on June 1, 1779, as follows:

> Those tiles are made for the dairy of Sr. Henry Harpurs, & the agreement for the price with Sir Henry was, that they should come as cheap, *p square yard*, as the Liverpool plain tiles which are sold at 2/6 P doz, or cheaper if possible. The tiles made at Etruria are 7 inches square, consequently each contains 49 square inches. Those made at Liverpool are only 5 inches. The contents of each 25 square inches; so that one dozn of the former

E. Stanley Wires

Fig. 20. Examples of the Nineteenth Century tile industry in the United States are displayed above. The Horses of Achilles (lower center) was made by Hugh Robertson, Chelsea Keramic Art Works. The tiles at lower left and lower right were also made by the Chelsea Keramic Art Works. The remainder of the tiles exhibited above were designed by Arthur Osborne of the Low Art Tile Works, Chelsea, Mass.

covers nearly as much surface as two dozn of the latter, & have greatly the advantage over them in several respects from being so much larger.

By the Nineteenth Century, the tile industry entered a commercial stage where quantity production began to be an essential of the business. Typical of the times was the company founded by Thomas Minton at Stoke. By 1836, Herbert Minton, his son, and two nephews, Michael Hollins and Colin Minton Campbell, became proprietors of the business which soon became a most important factor in the modern tile trade. Mr. Minton was not only a manufacturer of tiles but he was a diligent collector of old tiles, and many of his friends collected tiles for him.

About 1840, Richard Prosser of Birmingham invented a press to compress clay dust between metal dies. The Minton Company bought the patent, which is the basis of the present industry. When Herbert Minton died in 1858, his firm employed about 1,500 people.

Other important manufacturers of English tiles were Maw and Company, Dunnill and Company, the Campbell Brick and Tile Company, Henry Doulton and Company, and T. and R. Boote. Josiah Wedgwood and Son again manufactured tiles from 1870 to 1902.

Development of the Tile Industry in the United States

In the late Nineteenth Century the tile manufacturers of England and Scotland had established numerous sales agencies in the United States. Many

tiles were imported for fireplace mantels, and tiles showing historical pictures were used for advertising purposes. The clothing store of Macullar Parker Company distributed many English tiles, and the Jones, McDuffee and Stratton Corporation issued annually, from 1881 to 1929, a Wedgwood tile calendar. These tiles also showed many important New England subjects, among them being the M.I.T. buildings in Cambridge, as may be seen in Fig. 19.

The first tiles produced in the United States were probably made about 1845 at the factory of Abraham Miller in Philadelphia. Edwin Atlee Barber* in his book, *The Pottery and Porcelain of the United States,* tells us that Mr. Miller was making octagonal spittoons, which he cut in half and utilized as a wall tile decorative border around the ceiling of his office. His pottery also produced small quantities of mottled paving tiles and facing tiles for exterior use.

In 1853 the United States Pottery of Bennington, Vt., produced enough inlaid tiles to cover the floor space under their exhibit at the Crystal Palace Exhibition in New York.

In 1872, James Robertson, a Scotch potter who had arrived on the old sailing vessel, *Lord Mulgrave,* in 1853, joined his two sons to establish the Chelsea Keramic Art Works in Chelsea, Mass. This company claimed the distinction of making the first pressed clay tiles in the United States. Examples of early American tiles appear in Fig. 20.

In 1876, the Centennial Exposition opened in Philadelphia. Tourists were advised to allow three days to cover the 75 acres of buildings and 25 miles of walks. The elaborate European tile exhibits stimulated great interest, and shortly after the close of the Exposition, tile factories were erected in several states. Typical of this early expansion was that of the American Encaustic Tiling Company, Zanesville, Ohio, founded in 1875. This company was the pioneer in quantity floor and wall tile production, and numbered among its designers Leon and Paul Solon – sons of the noted English ceramist. By 1930, it controlled the largest tile organization in the world, but later succumbed.

Since its origin a century ago, the tile industry in the United States has made spectacular growth; its 50 factories doing an annual business of $60,000,000 at least. From the year 1900, when only the wealthy could afford a tile bathroom, we now find that tile is accepted as a desirable material in public and industrial buildings, as well as in most of our homes.

The Seventeenth Century Guild of the Netherlands has been replaced by our unions, and the Tile Council of America represents 80 per cent of the industry. Research programs are being established and new techniques developed. Typical of the individual members of the Council is the Cambridge Tile Manufacturing Company of Cincinnati, Ohio. This company, realizing the importance of color, has retained the services of the well-known color consultant, Faber Birren, and in matters of design the company consults with the Institute of Contemporary Art of Boston.

The development of decorative tiles in the United States has followed the architectural trends, and previous to World War II considerable progress had been made in the production of decorative tiles.

* New York: G. P. Putnam's Sons, 1893.

One of the earliest potteries was the Low Art Tile Company of Chelsea, Mass., founded in 1878. In a little more than a year after it started, this company entered a competition at Crewe, Stoke-on-Trent, and won the gold medal for the best series of art tiles over all the important manufacturers of England. This record, probably unsurpassed in ceramic history, shows the rapid development of the industry in America. Other notable potteries specializing in ornamental tiles were the Rookwood Pottery, Cincinnati; the Grueby Faience and Tile Company, Boston; the Mueller Mosaic Company, Trenton; the Moravian Pottery and Tile Company, Doylestown; and Gladding, McBean and Company, Los Angeles.

Tile Club

One can hardly conclude this history of tile decoration without reference to the work of the Tile Club, 1877 to 1887. The club was composed of young American artists in New York who sought a common ground of fellowship and discussion. The medium selected for their expression was painting or modeling on tiles. Originally planned with a membership of 12 artists, the club grew to some 30-odd. Each member was given a nickname and we find in the early roster: the illustrator, Edwin A. Abbey (The Chestnut); the sculptor, Augustus Saint-Gaudens (The Saint); the writer, F. Hopkinson Smith (The Owl); the painter, Winslow Homer (The Obtuse Bard); and the architect, Stanford White (The Beaver).

On Wednesday nights the Tile Club met at members' studios, and painted on 8 × 8-inch white tiles, after which a light refreshment was served. The regular evening meetings were supplemented by weekend sketching expeditions, the accounts of which can be found in the old *Harper's, Scribner's* and *Century* magazines. This group of notable painters, sculptors, and decorators saw in the use of tile decoration a very personal expression of their talents.

For a large part of the information in these articles the author is indebted to those whose works are listed below.

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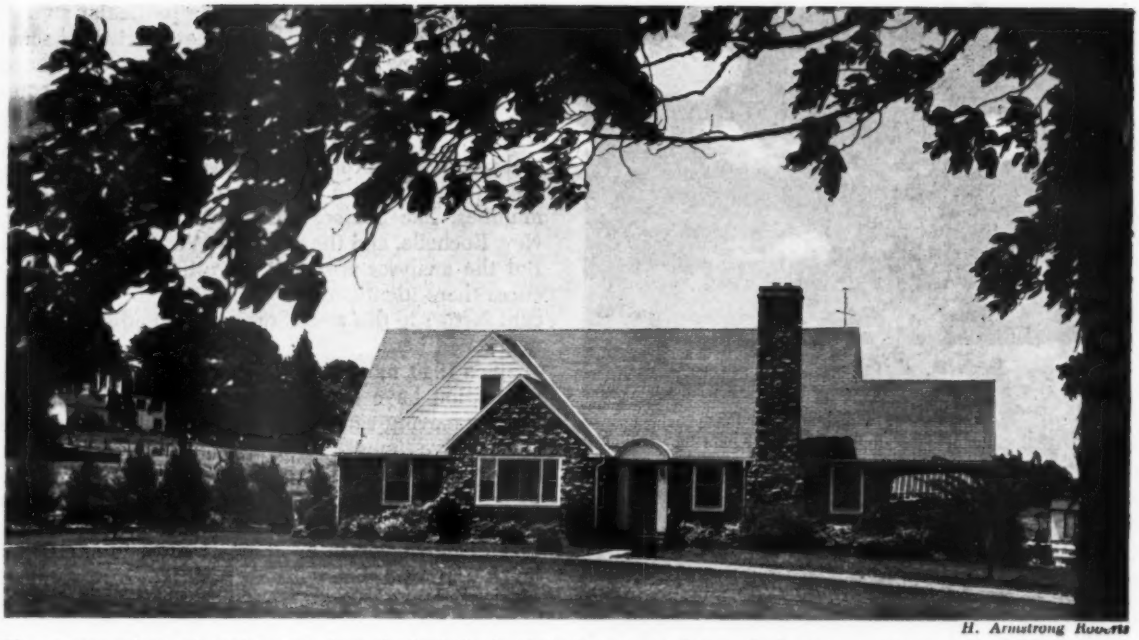


H. Armstrong Roberts

The nervous release of getting away from the hurly-burly of the big city, to sleep and play in an environment which is closer to nature, is surely one of the factors which explains the suburb.

Today's Challenge—

TO THE FAMILY IN SUBURBIA

By KARL T. COMPTON

THE suburb is not a new phenomenon. The writer recalls reading about the suburbs of ancient Rome. In his very interesting book, *The Culture of Cities,** Lewis Mumford quotes from the English *Courier* in describing the Sixteenth Century suburb as follows:

"The manner of most gentlemen and noblemen also is to house themselves (if they possibly may) in the suburbs of the city, because most commonly, the air there being somewhat at large, the place is healthy, and through the distance from the body of the town, the noise is not much; and so consequently quiet. Also for commodity we find many lodgings, both spacious and roomy, with gardens and orchards very delectable. So with good government we have little cause to fear infection there as in the very country; our water is excellent and much better than you have any, on ground and fields most pleasant."

Supposedly, the basic lure of the suburbs now is much as it was then. But two or three new factors have entered in. One is primarily sociological: the great increase in population and its centralization. The others are technological or at least made possible by technological developments — the expansion of modern transportation and communication which have vastly extended the area feasible for suburban living, and the techniques of home construction which have put suburban living within the means of great groups of families of the so-called middle class, as distinct from the noblemen and gentlemen as those terms were understood in the Sixteenth Century. In other words, the suburb has become vastly bigger in total scope, and much more democratic.

Another observation adds to the background of our thinking. It is that a suburb is not a unique type of community, any more than a mammal is a unique type of animal. A mammal may be a mouse, or it may be an elephant. A suburb may be a small, semirural community, or it may be a Levittown, or anything between.

By a stretch of definition, I may have lived in a suburb during my residence in Princeton. That university town, then of about 5,000 population, was a desirable residence for people who desired such an environment for their families — and who did not have to punch the time clock in New York or Philadelphia. Consequently there was a tendency for wealthy people to move in; they could outbid the college professors for the available homes — a situation which was aggravated by the fact that the town was surrounded by large estates and had no place to grow. (This situation was subsequently eased by the breaking up of some of the estates and by the increased

* New York: Harcourt, Brace and Company, 1938.

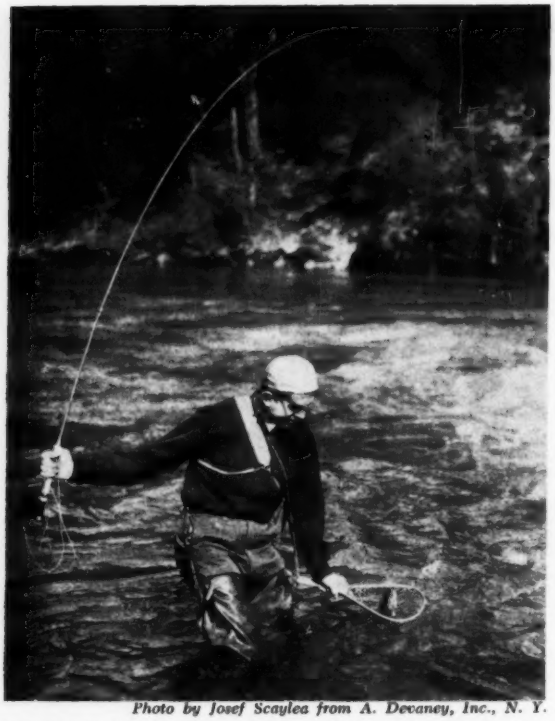


Photo by Josef Scaylea from A. Devaney, Inc., N. Y.

Our physical and nervous health require that we take time off once in a while to go camping, fishing, or boating.

dependence on the automobile, which could quickly circumvent the barriers.)

The story is told of one of these wealthy residents, whose wife was very conscientious about getting him off in the morning in time to catch the commuting train for New York. One morning she had an especially difficult time to get him up and off, and she only did so by sending him off without his breakfast. Then, with relief, she set about her other morning chores. What was her surprise, a half hour later, to come into the dining room and see him there calmly eating his breakfast. She wanted to know what had happened. "Well," he said, "it just occurred to me that I own the bank, and so they can't fire me."

This story may stir some experiences in the memories of some of you, whether or not you own any banks.

My point in mentioning the diversity of types of suburbs is that it is probably hard to generalize on the problems of Suburbia. The suburbs in Westchester County are rather different in character from many of those on Long Island, for example, or in another way, from those surrounding London. But just as all mammals, from the mouse to the elephant, have basic characteristics in common, so do suburbs; and it is these basic characteristics, as they affect family life, that are the subjects of our interest.

There was a very interesting series of four articles by William H. Whyte, Jr., in the May, June, July, and August, 1953, numbers of *Fortune* magazine dealing with the characteristics of suburban living. They were entitled: "The Transients," "The Future, c/o Park Forest," "The Outgoing Life," and "How the New Suburbia Socializes." Probably the particular studies there reported are more exactly characteristic of some of the big new suburban developments which have sprung up as brand new communities under the combined stimuli of postwar pressure for new housing, large-scale, real estate commercial developments, and the ideas of professional town planners than they are of the older and more stabilized suburban communities, like Scarsdale, Larchmont, White Plains, New Rochelle, and the others of Westchester County. But the analyses are very interesting, and the influences there identified are without doubt also significant factors in this area. Some of the findings may be mentioned here.

Since 1940, more than three-quarters of our nation's population have changed their addresses. The five leading moving-van firms are moving families at from three to five times the rate of their immediate prewar activity. Seven out of 10 of these families are expected to be moving again within five years. Most of them are in the 25- to 35-year age group. It is not just a question of moving from one part of town to another; a large portion are moving to new localities. College graduates are moving with about three times the frequency of the noncollege group. What is the explanation of these facts?

Large corporations, plus governmental agencies including the armed forces, account for more than 70 per cent of these moves. In the case of corporations, this is part of a program of broadening the base of experience, and at the same time trying out for adaptability in new jobs, their younger managerial personnel. Whyte lists, as typical of these migratory groups, young industrial civil servants, technicians of society, junior executives, research workers, young corporation lawyers, engineers, salesmen. They are organization men, and all on the move.

In some cases, this rapid turnover breeds some antagonism between the young groups on the move and the older, more permanent residents of the communities. This takes tactful dealing and behavior on both sides, and is a point to which large corporations should give very careful attention when they contemplate moving a large group of new personnel into a relatively small community.

One of the unexpected phenomena associated with this mobility is the fact that these young transients are not bothered by the instability and loneliness which might be expected to result from their frequent shifts of location. On the contrary, they have exhibited an extraordinary interest in community affairs and in each other. They tend, more than the older residents, to become joiners in community enterprises. They help each other out in the care of children, they are actively concerned with the educational, recreational, and civic affairs of the communities. As a matter of mutual self-protection, there is little tendency to "put on the dog" and try to "keep up with the Joneses" — or a little ahead of them. In these vibrant new communities there are many opportunities for leadership, and a survey under the auspices of the General Electric Company finds, as might have been expected, that the young people who have demonstrated leadership talent in the affairs of these communities are preferred "good bets" for advance-

ment in the managerial staffs of their employing companies.

The social groupings within these new suburban areas are determined, of course, by a variety of factors: the natural interests of the individuals, their character, and so on. But, according to Whyte's study, "It is the children who set the basic design; their friendships are translated into the mothers' friendships and these, in turn, into the families'." This conclusion is demonstrated by such observed facts as these: Where there is a through traffic street which children are forbidden to cross, the family friendships tend to group on one or the other side of the street; not to cross it. Where there is no traffic hazard, this is not true. Where there are play lots, the family acquaintances tend to group around these lots.

Another characteristic of these communities is the emphasis which parents place on the function of the schools to provide the pupils with a strong sense of citizenship, or group adaptability and co-operation, even at the expense of some sacrifice of book learning, In this connection the writer is reminded of the very sage observation of a young English school teacher whom we met in London last fall.

A group of us had been discussing the relative strengths and weaknesses of primary and secondary education in England and the United States. Some of us had been impressed, during World War II, by the assumption on the part of all the British children, who came to our country to escape the bombing dangers in London and elsewhere, that they would be academically one or two years ahead of our children of the same age. This attitude is generally held in Great Britain — and with some justification.

This young teacher from England had spent some months in the United States, studying the workings of our public school system, and had written a short article giving her conclusions. In it she said essentially:

"British criticism of the American public schools seems to be based on the assumption that the purpose of the American schools is to train good little Britishers. This is not the Americans' problem: it is to wield into a cooperating working group the greatest number of people of widely diverse backgrounds and origins which has ever been brought together in so short a time. This the Americans are doing magnificently, and in this program the American public schools are playing a major role." She went on to say also that, while this special job did result in some retarding of our pupils, academically speaking, in their earlier grades, as compared with British children of the same age, it was her observation that this gap was completely overcome by the time the pupils had reached the college levels.

This experience is mentioned because it seems to be somewhat analogous to the problem of welding together the diverse new groups who are brought together as children in our suburbs. The experience of adaptation, and the mingling of people of different backgrounds and often from different parts of the country, cannot but have its later influence in the developed understanding of different people, of differing points of view, and the ability to work together in the vast complex of interests and backgrounds which make up our nation.

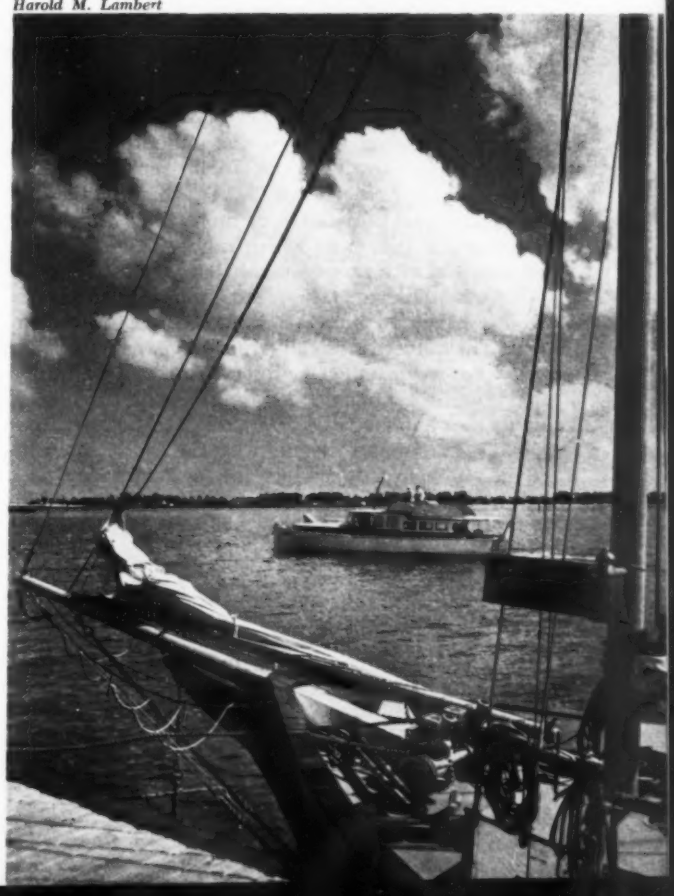
One phrase in Lewis Mumford's book struck me especially, and set me to thinking. It was: "The romantic suburb was a collective effort to lead a private life." This is a nice, neat phrase. Perhaps it was true in days gone by. But is it a true description of the urge which takes people from the cities to the suburbs today? What are the reasons? They are doubtless many, and each suburbanite must have considered them, as they apply to his own situation. Let us try to analyze a few of them.

In the first place, it is doubtful if the real reason is an "effort to lead a private life." Perhaps the most private life imaginable is that of a hermit, and this is certainly not the definition of a suburbanite. The next most private person, probably, is the city dweller in a hotel or apartment house. To be sure, there are plenty of people around — too many — but as a rule the horde is too vast to invite selection of friendships on the basis of propinquity or common interests.

The experience of a friend whose son had recently taken a room in an apartment house may be cited. When the young man came home for Christmas vacation, his father asked him what his neighbors were like, and was surprised to learn that he had not become acquainted with them. To his father's comment that it would have been the natural thing to do to meet them, the young man replied, "But father, why should I try to meet them? I might not like them." In this particular case it happened, by rare chance, that

The problem of afterschool facilities and activities for children ranks only a little below the schools in the importance of its influence on the wholesome development of young people.

Harold M. Lambert



H. Armstrong Roberts

Of essential importance to a community is that of having an excellent school system.

the father was later comparing notes on their respective sons with a man whom he met in another city, and it developed that their two sons had the adjoining rooms in this apartment house. But each had gone his separate way.

It may be that, rather than an effort to lead a private life, the satisfaction of the suburbanite is in being a part of a community whose size is within his powers of association. In the smaller community he can have some personal influence in community affairs; in the big city he is just an atom. In the suburb he can help to mold the environment in the direction of his tastes and his desires for his family; in the big metropolis he is but one of hundreds of thousands of voters. In other words, a suburban community is of manageable size; it is a moot question whether our very large cities are really capable of wise management.

There is another factor which undoutedly is part of the urge to move from the city nearer to the country – an anthropological factor. An Abercrombie and Fitch catalogue of a dozen or more years ago had a philosophical preamble which expressed an interesting thought with an argument that went as follows:

For countless generations our prehistoric ancestors lived a primitive life, in intimate contact with Nature. They lived in small groups, in the woods or caves. For reasons of self-preservation, they had to be alert to all the phenomena going on in the world of plants and animals, of fishes and insects, of weather and seasons around them. All of this was deeply ingrained in their genes and nervous systems.

Now in our technological age, the social environment is greatly changed. People live and work together in immense groups. There is a new pressure to life, and the pressure is of new types. All this has come about in the period of a very few generations, as compared to the almost infinity of time during which our fundamental physical and nervous characters were developed.

The argument was advanced, therefore, that our physical and nervous health require, from time to time, a period of relief from the new tensions and the refreshment of going back to some aspects of the environment which was our long heritage. Therefore, say Abercrombie and Fitch, take time off once in a while to go camping, or fishing, or canoeing – and we will help you with your outfitting. Being one who enjoys such things, the writer quite approves.

Some part of the same argument can apply to living in the suburbs. The nervous release of getting away from the hurly-burly of the big city to sleep and play in an environment which is closer to Nature, even if this environment is not exactly primitive, is surely one of the factors which explains the suburb.

The writer recalls a personal experience many years ago which gave him a bit of a shock. I had occasion to be taking a long trip by train with my little daughter, then just past four years of age. In trying to keep her amused, and for her education, I was pointing out various things which we saw from the train, and discussing them with her. We passed a field in which several horses were grazing. I asked her what they were doing, and she replied, "They are eating worms." Then and there I decided that her education in the facts of life had been sadly deficient, and that she needed more contact with Nature, in the country.

However all these things may be, the really important factor leading to the suburbs is the welfare of the family, and especially of the children. This seems to be the conclusion of every student and commentator whose statements the writer has read or heard. A few examples are quoted.

Lewis Mumford says: "Women and children first is a sound motto; and the instincts which prompted this exodus by the middle classes were sound; life was actually in danger in the new factory slum, and the merest counsel of prudence was to flee – flee with all one's goods, as Lot and his household had fled before the sultry hell of Sodom and Gomorrah . . . In a sense, the suburb was woman's special contribution to the new urban complex: for the suburb alone met the needs of childbearing and child rearing."

The Public Administration Service, in 1948, published a report on Planning the Neighborhood. It was the work of a committee of city planners, under the chairmanship of our colleague, Professor Frederick J. Adams, Head of the Department of City and Regional Planning at M.I.T. This report gives, in considerable detail, the standards for community development which represent the best experience and thinking, to date, by these students of the problem. One thing which is significant, for our present purpose, is their acceptance of what is technically known as the "neighborhood" concept as the most convenient unit for planning on a scale larger than the individual residence. This "neighborhood unit" is defined as the area served by an elementary school.

This same concept is accepted by the distinguished planner, Catherine Bauer, as the basic unit for consideration by sociologists and city planners. She states that this neighborhood unit is defined by the area and population served by an elementary school, and that this is usually thought of in terms of a population between 2,000 and 8,000 and with an area of 50 to 250 acres, depending on the density of the population, at least in a fairly well built-up area.

(*Continued on page 210*)

THE INSTITUTE GAZETTE

PREPARED IN COLLABORATION WITH THE TECHNOLOGY NEWS SERVICE

How Christmas 1953 Came to Tech

OLD Scrooge had never heard of Technology and, for that matter, neither had Bob Cratchit nor Tiny Tim. But had these illustrious characters from Dickens got a glimpse of the Spirit of Christmas 1953 which permeated the Cambridge campus and its environs, under the influence of good-will projects initiated by M.I.T. undergraduates, their eyes would have shone. They would have understood – and of course they would have approved – the spirit of doing for, and of giving to, others which motivated the efforts of Institute undergraduates. And certainly they would have rejoiced at the many successful efforts on the part of groups as well as individuals, to spread the true Christmas spirit within the Tech community. Perhaps, Scrooge, most of all, would have wondered how it was possible for anyone to look upon embryo engineers and scientists as preoccupied with material matters and lacking in the human touch.

True enough, the Christmas tree and holiday decorations set up in the main lobby had been the practice for years, although this year the Institute Committee took on the responsibility for the decorations. So too, there was no novelty in the hour of singing Christmas carols and in the annual Christmas message from James R. Killian, Jr., '26, President of the Institute, which, this year, took place on the morning of December 18, just before most of the students left for their Christmas vacations.

But somehow, Christmas 1953 was different from what it had been in previous years. For a brief spell, at least, the wearisome "dialectic materialism" which has been forced upon one-sixth of the world's population was forgotten as thoughts turned to the change wrought in man's spirit by events taking place in Bethlehem nearly 2,000 years ago. A conscious effort was made to create an aura of understanding friendship for many who might otherwise feel lonely and forgotten, and once more the discovery was made that it is more blessed to give than to receive. It was the first time in which residents of dormitories joined the fraternities to take part, as an integrated Tech community, in bringing Santa Claus to several hundred children in the metropolitan area, and the 1,000 or more students who participated found a new meaning in the awe, wonderment, and joy which was registered in the faces of their young guests.

Believing that a latent spirit of co-operation merely required a bit of leadership, Dean L. Jacoby, '54, President of the Institute Committee, Albert A. Ward, Jr., '54, President of the Interfraternity Conference, Charles J. Masison, Jr., '54, and Peter B. Brand, '55, took the leadership in bringing Christmas spirit into better focus than in the past.

Sparked by this group of leaders in undergraduate affairs, students spontaneously responded in the opportunity to "do for others," and a twofold program emerged. There was, first of all, a program of creating, through usual seasonal decorations, a physical means for being reminded of the Christmas spirit. But the significant part of the program was the development of the spirit of giving, to others, that warmth of human friendship which makes life worth while.

As a result of such leadership, the Interfraternity Conference inaugurated and carried out a series of Christmas parties for worthy children on Saturday, December 12. Of the 26 fraternities at M.I.T. at least 16 set aside the period from 2:00 P.M. to 5:00 P.M. on December 12 to play hosts to children between the ages of four to 12, and to brighten the holiday for several hundred youngsters whose expectations for a visit from Santa Claus were somewhat feeble. It was a novel experience for would-be engineers and scientists to cast aside their slide rules, to use their own cars to pick up several hundred youngsters from various homes and hospitals in metropolitan Boston, and to bring these eager but shy children to fraternity houses for a joyous afternoon to play games, to see a real Christmas tree with decorations, and to have a visit from Santa Claus. It was something new for most Technology students to entertain the younger set, but in these well-meant if inexperienced intentions, the students were aided by their ladies. It was a novel experience, too, for engineering students to learn the names of – and something of the backgrounds and childish wishes of – their young guests, so that one of the bewhiskered brothers, in traditional red and white costume, could make remarks appropriate for Santa Claus as he handed out candy or gifts to the wide-eyed youngsters. It was also a matter of temporary consternation to discover one or two heads missing as the parties came to a close, and to find that one of the youthful absentees was a four-year old

Mr. and Mrs. Jan Arkuszewski celebrate a real American Christmas when Santa Claus (Joel B. Searcy, '57) unexpectedly visits them and their three children – Alexandra, Alena, and Richard.
Boston Herald

who was happily entertaining himself by examining the mechanics of a polyphase duplex slide rule.

The dormitories, too, had their share of bringing cheer to Boston children. Decorated with wreaths and other trimmings appropriate for the season, Baker House, Burton House, and the East Campus were ready for their part of the festivities which paralleled that of the fraternities.

On the afternoon of December 12, student residents of Baker House visited a hospital for retarded children up to 16 years of age, and brought to them a friendly spirit as well as gifts. On the same day, residents of Burton House and of East Campus took their gifts to local hospitals and houses for children in the nine- to 12-year age bracket. Students taking part in these activities enjoyed much the same experiences as were encountered in the fraternities as youngsters who might well feel forgotten became "king for a day."

On the evening of December 12, the dormitories held dance parties, which were turned into co-operative projects of trimming Christmas trees and carrying out other decorative tasks as a community operation.

Nor was the Christmas spirit exclusively limited to administering to the needs of pre-teenagers. On December 16, an undreamed of Christmas – in free America – materialized for Jan Arkuszewski, his wife, Irene, and their three yellow-haired children, aged two, four, and six years. Mr. Arkuszewski had served in the Polish Army, was captured at Warsaw, spent years in a Nazi concentration camp and, on April 23, 1945, lost both his legs in a night bombing raid. He came to the United States about a year ago and was making a brave new start in a new country when he was struck by a hit-and-run driver in mid-November. On top of these misfortunes, it looked as if Santa Claus might have difficulty finding the tiny West End apartment where the Arkuszewskis live.

But Mr. Arkuszewski is employed at Walker Memorial and hence was known to many Tech students living in East Campus. These students decided that Jan had had enough trouble for a while, and on December 16, four undergraduates aided Santa in distributing dolls, teddy bears, and other gifts selected to delight the fascinated youngsters. Joel B. Searcy, '57, in red and white costume of the season was assisted by Messrs. Ward and Brand, and – most of all – by Jan Krizik who acted as interpreter. It was Mr. Krizik who conveyed to the rest how Mr. Arkuszewski felt about the whole matter. The gist of Mr. Arkuszewski's remarks, excitedly expressed in German, was that it's wonderful to be in America and to be free again.

On the evening of December 17, a program of choral caroling (aptly termed "choraling") got under way at the President's House, at the residence of the Dean of Students, and at the three dormitories. Aiding the students in this choraling activity were Mrs. James R. Killian, Jr., at the President's House, Mrs. E. Francis Bowditch at the home of the Dean of Students, and Mrs. Laurens Troost, Mrs. Holt Ashley, and Mrs. Samuel J. Mason, as Faculty residents at Burton House, East Campus, and Baker House, respectively. In addition, Faculty residents held open house for the students in the dormitories who were unable to return to their homes for the Christmas holiday and, as a final act of the Christmas season, every effort was made to see that students from foreign countries had an opportunity to have Christmas dinner with some member of the Faculty in Cambridge.

How were these things possible? How could busy students in an environment frequently characterized as "Tech is Hell" find the money, time, and most important, the spirit to put such a program into effect?

Well, the finances were readily taken care of by contributions from the various fraternity houses, and in the dormitories, by contributions from individual students who pooled their resources. The Interfraternity Conference was able to obtain a 20 per cent discount from local merchants in purchasing toys for children and, after all, a little money can go a long way in bringing happiness, especially to children. Perhaps no accurate account is possible, but it seems safe to say that $500 covered the cost of parties.

The Institute's Administration gave encouragement to the program in which it is estimated more than 1,000 of the 3,500 undergraduates took an active part in one way or another. And when a big job is tackled co-operatively by large numbers, the individual burden is a light one, quite out of proportion to the benefits and joy derived. Names of hospitals and homes in the Boston area where children could be visited, or where they could be called for and delivered, were supplied by the Technology Christian Association.

George E. Russell: 1877-1953

ANNOUNCEMENT of the death on December 11, 1953, of George E. Russell, '00, Professor of Hydraulics, Emeritus, was sorrowfully received by The Review. For 39 years he was a member of the faculty of the Department of Civil and Sanitary Engineering at the Institute until his retirement in 1943.

Professor Russell joined the Institute staff in 1900 and during World War II served on the Advisory Board of the United States Coast Guard Academy.

He was born in Boston on December 25, 1877, and received the degree of bachelor of science at M.I.T. in 1900. Following a year as assistant in civil engineering, Professor Russell went to New York as designing engineer for the American Car and Foundry Company, where he designed the first noncombustible steel passenger car for use in subways. From 1904-1905 he also taught at Cornell University, and in 1905 returned to M.I.T. as instructor in civil engineering. Professor Russell was promoted to assistant professor in 1907, associate professor of hydraulic engineering in 1913, professor of hydraulics in 1921, and emeritus professor and lecturer in hydraulics in 1943.

When the M.I.T. Hydrodynamics Laboratory and Ship Model Towing Tank was dedicated in June, 1951, Professor Russell was chairman of the afternoon symposium "Hydrodynamics in Modern Technology."

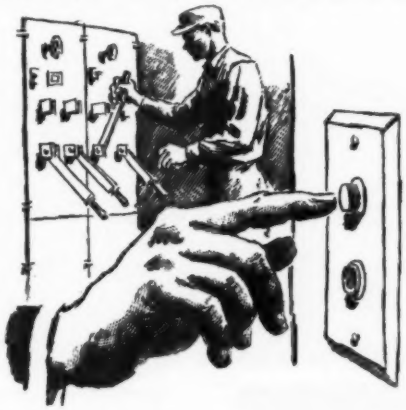
In addition to his Institute activities, Professor Russell served as design engineer for the state's Charles River Basin Commission; traffic and structural engineer for the Boston Transit Commission; civil service examiner for state engineers; and engineering consultant to the U. S. Navy, to industry, and to many New England municipalities.

(*Concluded on page* 208)

BUSINESS IN MOTION

To our Colleagues in American Business . . .

About a year ago the president of a great electrical company wrote to his stockholders: "It is probable that in the next ten years as much electrical equipment will be built, sold and installed as has been built and installed in the industry's past 75-year history . . . In fact, the electrical industry must be prepared to grow more than twice as fast as the remainder of the economy." Recent figures forecast confirmation of his amazing prediction. Construction of new electrical facilities during 1953 exceeded $4 billion, according to reports from utilities operating 92% of the country's capacity and serving 83% of electric customers. Charts of generating capacity and consumption continue to show large increases. Spectacular growth continues, not only in ability to produce electricity, but to transmit and use it.



Edison wanted to make an electric light, but this was not the only project that interested inventors and investors, who saw in electricity not only light, but a new source of energy to serve in a multitude of ways. That energy, in a space of time that is short relative to industrial history, has substituted individual motors for belts, taken burdens off muscles and put them on armatures, and brought new efficiency to the home, the factory, to transportation, to communication, to so many of man's activities around the clock. Electricity, once a marvel, has become a servant which daily finds new duties to perform, greater power of accomplishment, and new ways to do its tasks better.

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(Concluded from page 206)

Killian Gives Principal Address at Brandeis Graduate School

TECHNOLOGY'S President, James R. Killian, Jr., '26, delivered the principal address at inauguration exercises marking the opening of Brandeis University Graduate School of Arts and Sciences, which was held at the University on Thursday, January 14.

More than 150 official delegates marched in the exercises, including fellows and trustees of Brandeis University and members of the University faculty, six college presidents, 12 college deans, and faculty members representing scores of colleges and universities.

In addition to President Killian of M.I.T., other college presidents who took part in the ceremony, all from New England, were Trentwell M. White of Lesley College, Martin J. Lydon of Lowell Technological Institute, Grover C. Bowman of State Teachers College at North Adams, Royce S. Pitkin of Goddard College, and Alan S. Wilson of Hillyer College. The 12 deans who took part in the inauguration ceremonies all represented colleges and universities in the New England area.

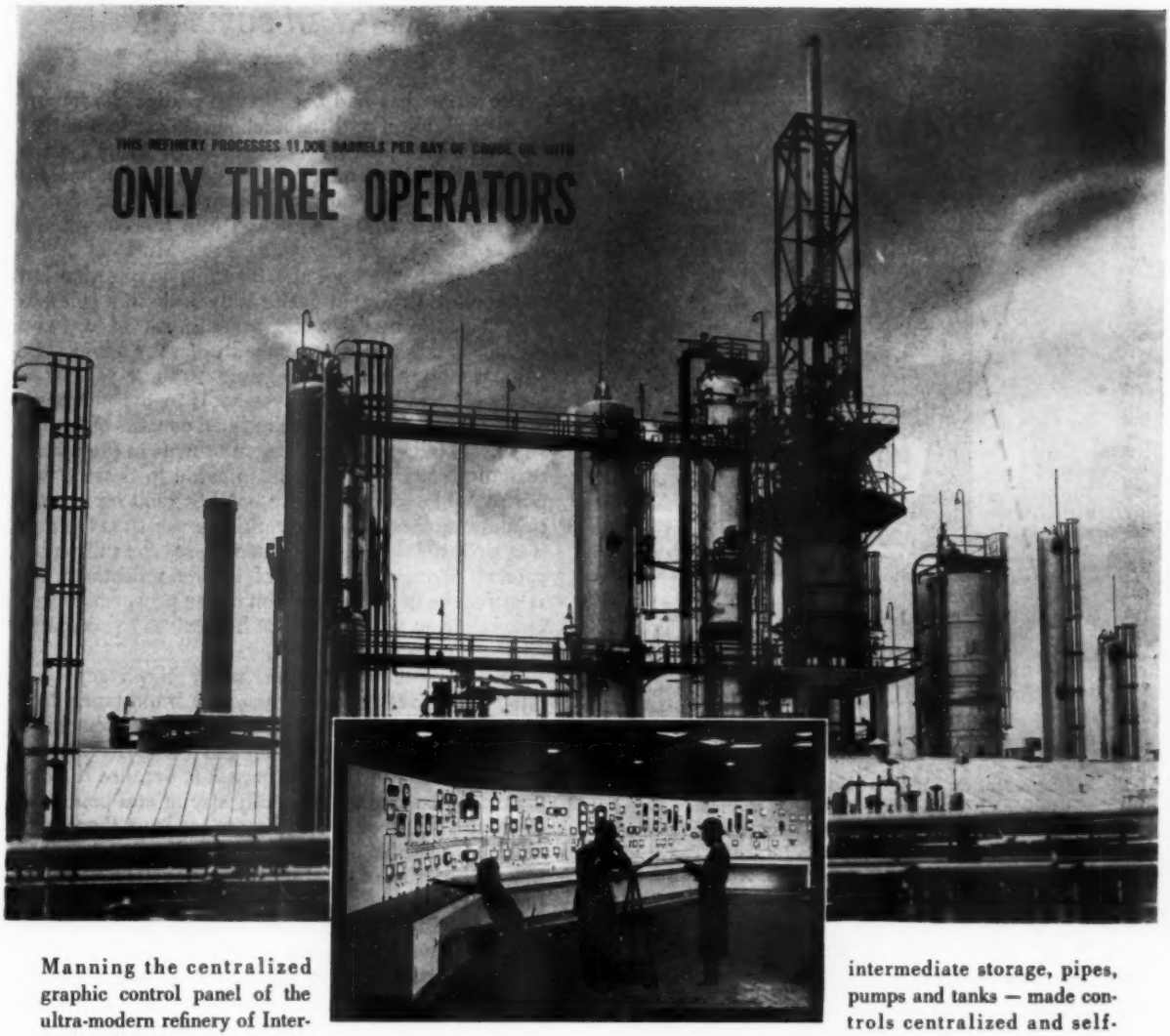
Faculty Member Awarded Educational Exchange Grant

THE Fulbright Committee at the Institute has been notified by the United States Department of State that Gerhard Reethof, '47, of Cambridge, Mass., an Assistant Professor of Mechanical Engineering, was awarded a United States Educational Exchange Grant for 1953–1954.

Professor Reethof will participate in the International Educational Exchange Program as a lecturer in machine design at the Institute of Technology in Helsinki, Finland.

The award is made under the provisions of Public Law 584, 79th Congress, the Fulbright Act. It is one of approximately 375 grants for lecturing and research abroad included in the program for the academic year 1953–1954. As provided by the Act, all candidates are selected by the Board of Foreign Scholarships, the members of which are appointed by the President. Lecturers and research scholars are recommended for the Board's consideration by the Conference Board of Associated Research Councils, which has been designated to receive and review the applications of candidates in these categories.

The funds used for carrying out the program under the Fulbright Act are foreign currencies realized through surplus property sales abroad. Under executive agreements with foreign governments, programs are currently in effect in the following countries: Australia, Austria, Belgium and Luxembourg, Burma, Denmark, Egypt, Finland, France, Germany, Greece, India, Iran, Iraq, Italy, Japan, the Netherlands, New Zealand, Norway, Pakistan, the Philippines, South Africa, Thailand, Turkey, and the United Kingdom.



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The reserves of low-cost fossil fuels are reviewed to determine how long these "capital" reserves will meet the hypothetical demands. The "income" sources, principally sunlight, are then examined, to learn if we can hope to meet the bulk of future demands for energy from these sources at low cost.

The final step is an estimate of the maximum plausible demands for low-cost energy from nuclear fuels.

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FAMILY IN SUBURBIA

(*Continued from page 204*)

The writer has had occasion to realize the importance of children and their schools as predominating factors in the choice of residence. At M.I.T., as at every university – or every large organization for that matter – there are every year a number of new staff members who are moving into the community and are looking for residences. Most of them have children of school age. There is no question but that their most urgent desire is to settle in a community which provides good schools. All of us, and especially our wives, are called upon for advice and help, and often to serve as guides to these parents as they visit and evaluate the schools in the neighborhood. In our case the neighborhood consists of Boston and its 43 independent cities and towns in the metropolitan area. Our staff tend to settle in those towns whose public schools have a notably good reputation. If homes cannot be found in these areas, then the turn is to private schools, and in such cases the tuition becomes a financial factor which is often reflected in our salary scale, or in the decision of the prospective staff member as to whether or not he decides to accept an offer of a position at M.I.T.

All of these experiences, many times repeated, indicate impressively the essential importance to a community of having an excellent public school system. Why do not some of our city officials recognize the importance of this? Perhaps it is because the citizens do not make a sufficiently strong and concerted effort to secure what all of them, at least those with children, feel the desire for so keenly. And irrespective of the value of good schools as a social investment for the future, they would be a good financial investment for the municipality. A large percentage of families have been willing to pay more for their homes in order to have the benefit of better schools.

This idea of sound financial investment in schools could be given a practical experimental test, as follows. Suppose several dozen residential communities, suburban and otherwise, were selected for the experiment. The effort would be made to select these communities so that they could be grouped in pairs, the two in each pair being as similar as possible in their present status as to size, type of population, economy, tax structure, and environment. By some means, one of the communities of each pair would be stimulated to take vigorous steps to improve its public schools, whereas nothing would be done or said about it in the other community. Then, after five or 10 years a survey would be made of the status of all these pairs of communities.

Based on the experiences described, we may surmise that the community with the improved schools would be found to have prospered more than its opposite number, and that the investment in the better schools would have paid for itself through the increased property values resulting from the added inducement to settle in the neighborhood. The author suggested this as a project for support by a foundation which was looking for new worlds to conquer, but nothing came of the suggestion, though undoubtedly

(*Continued on page 212*)

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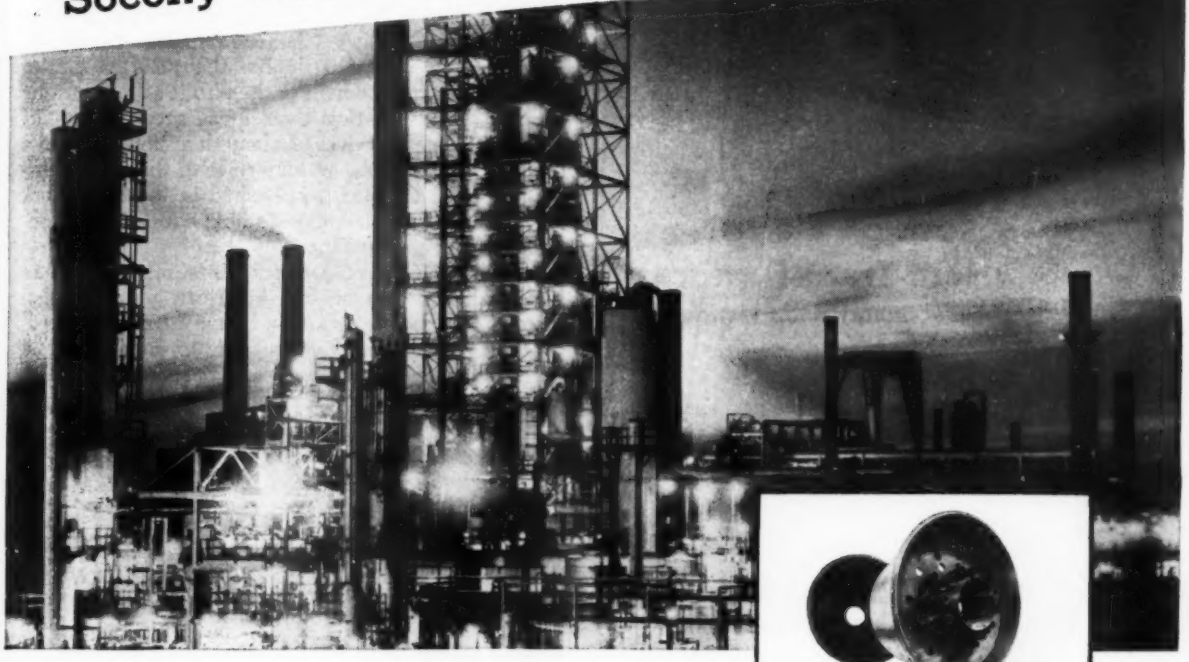

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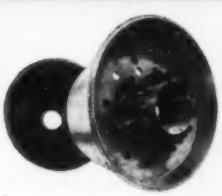

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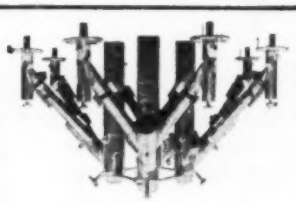

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FAMILY IN SUBURBIA

(Continued from page 210)

it has some merit. Perhaps the proof of the thesis already exists in the experiences of various communities, but has not yet stood out for all to see.

Here, in the support and improvement of the schools, is certainly one of the most important aspects of the topic "Today's Challenge to the Family in Suburbia." If any one doubts the need of better support and improvement of the public schools of our country, even granting their great accomplishment and the devoted services of many thousands of school teachers and officials, he may refer to the very informative series of articles published in the New York *Times* in 1947 by that paper's able educational commentator, Benjamin Fine.

In this connection the writer cannot refrain from an historical comment on our American public school system. As some of you know, I have advocated a program of universal military training to supply at least partially ready military reserves during the existing period of international danger. The opponents of such a program have over and over again characterized it as "conscription, undemocratic and Un-American." Some one told me that these same epithets had been used to oppose the proposal of a universal system of compulsory public school education in our country. One time, when I had a little leisure, it occurred to me to see whether the *Encyclopaedia Britannica* had anything to say about this, and this is what I found. I quote from a section on Education in the United States.

By the close of the first quarter of the 19th century a great struggle for the creation of a series of tax-supported, publicly controlled and directed, and non-sectarian common schools was in progress, and the second quarter of the century may be said to have witnessed the successful conclusion of the battle. . . . Excepting the battle for the abolition of slavery, perhaps no question has ever been before the American people for settlement which has caused so much feeling or aroused such bitter antagonisms. . . . It was likewise the work of a generation to convince the masses that the scheme of State schools was not only practicable but also the best and most economical means of giving their children the benefits of an education; to persuade propertied citizens that taxation for education was in the interest of both public and private welfare; to show legislators that it was safe to vote for school bills; and to overcome the general opposition due to apathy, sectarian jealousy and private interests . . . the American State

(Continued on page 214)

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FAMILY IN SUBURBIA

(*Continued from page 212*)

school, free and equally open to all, was finally evolved and took its place as the most important influence in the national life working for the perpetuation of American democracy and the advancement of the public welfare.

(In the above, the term "State school" of course refers to what we call the public school.)

This bit of old history came as quite a surprise for probably we have all come to think of our public school system as an essential part and parcel of our American life, as it is. The fact that it was brought into being against great odds, and that it has functioned so well, on the whole, should make us ever alert to give it our vigorous and imaginative support.

When the children are not in school, they are somewhere else – at home, or at play or some other outside activity. What about their situation then? Their home situation will not be discussed here – for that is the special and intimate concern of every parent – but it may be pointed out that group activities of parents, such as the Parent-Teacher's Association, Mothers' Study Clubs, and the like, offer opportunities for help and guidance. Last September one of the New York papers carried a story about an organized study, by a group in Westchester County on the problem of the afterschool facilities and activities for the children – a subject which ranks only a little below the schools in the importance of its influence on the wholesome development of our young people.

The importance of these out-of-school activities of young people can be evaluated, and they can be wisely directed, in the light of some very fundamental characteristics of children and teen-agers. They have a lot of excess energy, which is bound to find outlet. If there are constructive outlets, that is all to the good. If these are lacking, or insufficiently attractive, then destructive outlets are likely to be the alternative. Most youngsters have a natural "gang" instinct, and this can be turned to advantage, or otherwise, according to the opportunities and incentives. Some children, on the other hand, are not of the sociable, extrovert type who turn naturally to group activities. What can be provided for them? Some experiences which can be related may be suggestive.

There is a strong tendency, in the colleges, to emphasize athletic sports for all, rather than to concentrate on a few winning intercollegiate teams, with most of the college community serving only as rooters

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and to swell the gate receipts. One time the author was discussing this with the Dean of the College at Princeton, and commenting on the great array of athletic fields, tennis courts, and so on. He said, out of long experience, "Since we have had these recreational facilities, the disciplinary duties of the Dean have fallen to a fraction of what they used to be."

When Vannevar Bush, '16, now President of the Carnegie Institution of Washington, was Vice-president of M.I.T., he took quite an interest in the boys who were not athletes, or musicians, or debaters, or social lights. They were a group of individualists who did not find their extracurricular outlets in the great variety of organized student activities. He conceived and set up a "hobby shop," with some materials and tools and a minimum of advisory supervision. This has proved to be a great success, and a wide variety of creative jobs are undertaken here at the initiative of the individual students – model airplanes, models of historic structures or machines, painting, furniture for the home, inventions, and so on. This has provided a constructive outlet for a very considerable group.

Illustrations might be multiplied to prove the value of wholesome competitive or creative activities. To the extent that these can be made available, and "sold" to the youngsters in such manner as to engage their interest and enthusiasm, the major problems of the out-of-school life of the youngsters are solved.

Of course the schools themselves play a very important role in these matters. The so-called "progressive" schools are especially interested, and some people think that some of them overdo this aspect of education at the expense of the fundamentals. However this may be, imaginative attention to these extracurricular matters is certainly an important matter for family concern.

Besides the schools, and especially concerned with the out-of-school activities of our young people are many of the social agencies, like the Boys' and Girls' Clubs, the Boy and the Girl Scouts, the community playgrounds and parks, the movies which may be wholesome or otherwise, depending on the quality of programs, the Y.M.C.A. and Y.W.C.A. and analogous organizations, and of course the churches and their Sunday schools and young people's organizations. All these have their place. Their diversity fits into the diversity of interests and characteristics of the young people who choose to participate in their activities. And, in this connection, there are the community social agencies, such as the Red Feather.

Out of the great variety of problems relating to life in the suburbs, only those which seem to be most important as bearing on the topic of the challenge to the family have been commented on in this article. There are of course many other factors which challenge the suburban family. There is the matter of taxes, and the relation between the tax structure of the suburb and that of the parent city. This is a perplexing subject, for the services and responsibilities of the two are not independent. To a large extent the salaries are earned in the city, and the taxes are paid in the suburb. To this extent, the city suffers financially, politically, and socially by the flight of substantial citizens to the

(*Concluded on page 216*)

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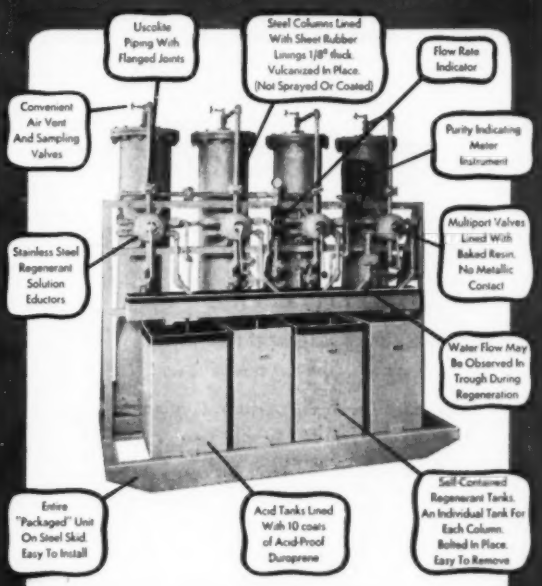
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FAMILY IN SUBURBIA

(Concluded from page 214)

suburbs. This is not to argue that the suburban exodus is individually or collectively improper; the advantages far outweigh the disadvantages. But the results on the central cities do create a problem which is a job for the city rather than the suburb to handle.

Some interesting suggestions for the better handling of the problem within the cities have been urged by William Zeckendorf in an article in the *Atlantic Monthly* of July, 1952. He points out that, if the cities were to undertake a really vigorous program of transforming slum, or "down at the heel," or blighted areas into attractive areas for residence and recreation and wholesome family development, several advantages would accrue. Those forced by circumstances to live within the cities would gain at least something of the advantages of suburban life. Standards of living would improve, and real estate values would rise, and tax rates could become more equitable. Politics would tend to rise above the present level of disrepute. The opportunity which he portrays is attractive. There may be some catches in the argument, at least as regards really large-scale application. Of course some things along this line are already being done. Perhaps the bearing of this phase of the problem on the family in suburbia is simply this: it is definitely to the advantage of the family in the suburbs to have a prosperous and wholesome city as its focus.

Some of the other problems of city and suburb will not be mentioned here, with the exception of a word on community administration which seems to be important as seen in operation in some regions.

In a good suburb of a metropolitan area there are many professional people of high grade and wide variety – lawyers, engineers, educators, business executives, and the like. They are generally very civic minded, proud and concerned with the welfare of their community, and willing to serve it to the extent that their other commitments permit. Many of them have served voluntarily and very effectively in their professional capacities in the affairs of their communities. They have provided a quality of professional service which the community could not buy or hire, and they have done it gladly. Here is one of the advantages of a not-too-large suburban town or city – for in a large city these professional services are so extensive and burdensome that they can only be handled by paid and full-time employees who are elected, or who come in through civil service, or who are politically appointed. Most of these professional employees are good civil servants, and we are all indebted to them for their service. However, there seems to be something very wholesome about a situation in which it is possible for people to give some part of their special talents and time to the successful operations of their communities. In big cities, or in Washington, this is also done through service on special emergency commissions, or while on leave of absence from their regular private positions. Service to the small community, of which men and women are a part, is an exceedingly wholesome thing for all.

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The second aspect of the Institute's financial problem is the need for sufficient new funds to guarantee the continuing support of its long-range program. This need must be met by grants from industry and foundations, by current gifts, and by bequests from individuals.

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M. I. T. SUMMER SESSION

(Continued from page 194)

89 further applications had to be declined because heavy demand for admission to particular programs exceeded the available facilities. Above and beyond the correspondence so represented, the Summer Session Office responded to 739 inquiries regarding specific programs and to 451 general requests for information. Thus, quite apart from its dispatch of initial printed publicity, the Office of the Summer Session corresponded with substantially 3,000 individuals about Special Summer Programs alone.

The 1,354 actual registrants in Special Summer Programs comprised 1,304 (96 per cent) men and 50 (4 per cent) women. Of this 1,354 total, more than two-thirds (930 = 68.7 per cent) were drawn from industrial companies, the remainder coming from government (267 = 19.7 per cent) or from other research and educational institutions (157 = 11.6 per cent).

From the viewpoint of normal geographical location, these 1,354 registrants came not only from 45 out of the 49 recognized geographical units of the United States, but also included 83 representatives of other areas, namely: Canada, 50; Canal Zone, 1; Cuba, 1; England, 3; France, 15; Honduras, 1; Pakistan, 1; Puerto Rico, 5; Mexico, 2; Sweden, 1; and Venezuela, 3. None of these overseas visitors include any Foreign Student Summer Project representatives. Considering the relatively short duration of the Special Programs, together with the fact that absolutely no publicity was sent abroad except in response to specific requests, such a high proportion of foreign representatives appears as a high compliment to the Institute reputation.

Of the 1,271 registrants from the continental United States, the widespread distribution is also impressive. New England furnished only 272 (21.4 per cent), while of the others, 826 (65.0 per cent) came from west of New England but east of the Mississippi River, 89 (7.0 per cent) from the West Central and Mountain areas, and 84 (6.6 per cent) from Pacific Coast areas. Only four states – Arkansas, Idaho, Mississippi, and North Dakota – were unrepresented.

The average age of the 1,354 Special Summer Program registrants was 34.9 years. The oldest age average for any individual program was 42.5 for the Westinghouse Science Teachers Program; the youngest age average was 31.5 for Technique of Infrared Spectroscopy. The oldest individual registrant was 71; the

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youngest, 21 (five cases). Registrants 50 years old, or above, numbered 67; those below age 25 numbered 40.

While the professional experience of the 1,354 registrants does not lend itself to numerical representation, the extent of their previous academic training is suggested by their degrees. Of the entire group, only 144 (10.6 per cent) held no college degree although many of these had some college enrollment; 748 (55.2 per cent) held at least one bachelor's degree; 340 others (25.0 per cent) also held master's degrees; while 122 additional cases (9.2 per cent) also held doctor's degrees. It thus is evident that although the lack of a baccalaureate degree is no bar to admission to such programs, to a great preponderance (89.4 per cent) of registrants these programs were in the nature of graduate or postdoctoral study.

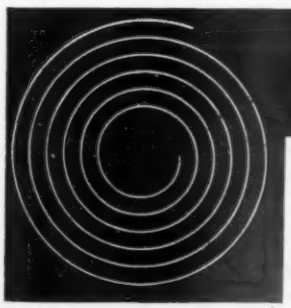
From the viewpoint of the size of the several Special Summer Programs as measured by the number of registrants, the largest single course was that on Noise Reduction (112), followed by Digital Computers (106), Strain Gages (84), and Automatic Control of Aircraft (82). The smallest individual program registration was 10 in Textile Research. Two of the 26 programs were specifically restricted in size, namely, that on Control Problems of the Executive, which accepted 25 and regretfully declined 13, and that on Mathematical Problems of Communication Theory, which accepted 48 and had to decline 24.

Of the 26 Special Programs offered in 1953, 10 were entirely new, 3 were broadly similar to previous programs of earlier years, and 13 represented repeats of 1952 or (in a few cases) earlier years.

Publicity for the Summer Session

In view of the increased scope and wider audience of the M.I.T. Summer Session, it is evident that corresponding changes have been required in the methods for making known its offerings for a particular summer. Part of the recent sharp increase of interest is almost certainly due to the word-of-mouth testimony of participants in previous sessions. Because this form of recommendation is especially persuasive, special effort is devoted to making every registrant's stay at the Institute as pleasant as possible, and to making sure that his comfort and convenience are served. Recognizing that registrants in special events are persons of affairs with many special responsibili-

(*Continued on page 220*)



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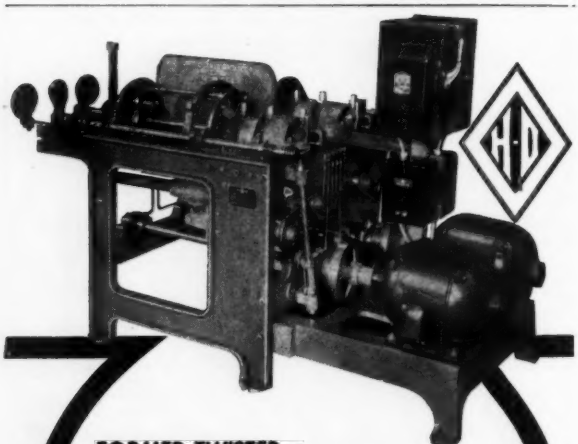

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M. I. T. SUMMER SESSION

(*Continued from page 219*)

ties and commitments not shared by students in regular subjects, problems of rapid location and communication arise in which special techniques and facilities of the Summer Session Office have proven their worth in winning the good will and warm appreciation of the professional public.

Although the best advertisement is well known to be the satisfied customer, it is also true that the particular components and schedule of the special events of the Summer Session change from year to year. This necessitates some kind of printed literature formulated, printed, and brought to the attention of those likely to be interested. With the assistance of the M.I.T. Office of Publications and the professors-in-charge of particular events, the Office of the Summer Session has developed a sequence of procedures which has been both fruitful and warmly received. These may be briefly portrayed as they apply to the three different aspects of the Summer Session.

General and Individual Announcements

The components of the annual series of Special Summer Programs are first publicly announced on January 1 by means of a preliminary announcement circulated to some 10,000 different individuals or companies. This announcement states what Special Programs are to be offered, when they are scheduled, what they are about, under whose direction they will be carried out, and includes a brief abstract of the nature and content of each program. This very early disclosure of schedule has proved most useful in enabling early plans to be formulated by potential registrants. Subsequently there is published during February and March a series of individual folders, each devoted to amplification of the particular subject, including details of organization, application, tuition, registration, living accommodations, recreational facilities, and so on. Inquiries regarding individual programs arising in response to the general preliminary announcement are answered by dispatch of the detailed folder. Each specialized folder is also

(*Concluded on page 222*)

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M. I. T. SUMMER SESSION

(*Concluded from page 220*)

sent to a substantial additional mailing list supplied by the professor-in-charge or his department. Total mailings of literature regarding the Special Summer Programs run about 50,000.

For practical reasons inherent in the nature of the Conferences and Symposia, the series comprising this aspect of the Summer Session cannot be completely formulated until about the first of April. General announcement of this group is therefore effected by inclusion of the list in all correspondence subsequent to its issue rather than by separate mailing.

Announcement of such regular Institute subjects as are to be scheduled for a particular summer is carried in the Summer Session Issue of the regular Institute Catalogue. In order to afford appropriate guidance to regular students planning for summer study, preprints of the summer schedule of regular subjects are made available to them prior to registration for the second term. As a matter of convenience, the Summer Session Issue of the Catalogue also carries the Special Summer Program schedule and descriptions, but such entry is primarily for cross reference purposes.

Forecast of the Future

The rejuvenated form of M.I.T. Summer Session has now been in operation for five summers. Experience over this period, particularly in the light of the massive increase of interest and registration in 1953, indicates that through its multiple aspects it is contributing significantly not merely to the convenience and academic progress of regular M.I.T. students, but also to the professional and technical advancement of hundreds of other persons who can now take advantage of the Institute's special staff, experience, and facilities. Although one of the Summer Session's chief problems perhaps may now arise out of its very success and appreciative recognition, it will endeavor to avoid the temptation to multiply its sequences of Special Programs and Conferences indefinitely, rather maintaining an appropriate balance with respect to the threefold character of its clientele, the timeliness, professional distribution and variety of its various offerings, and the effective utilization of its staff and facilities.

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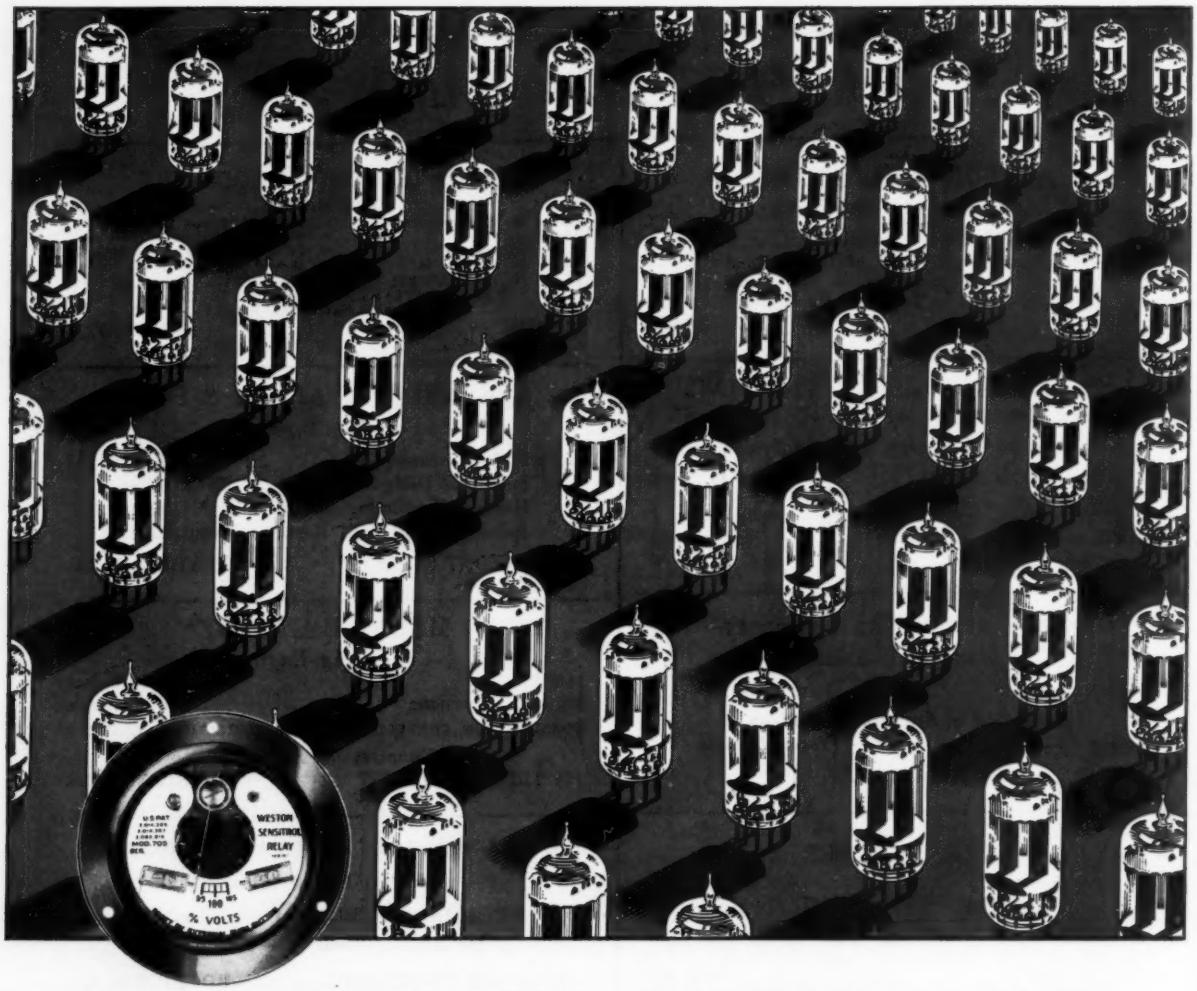

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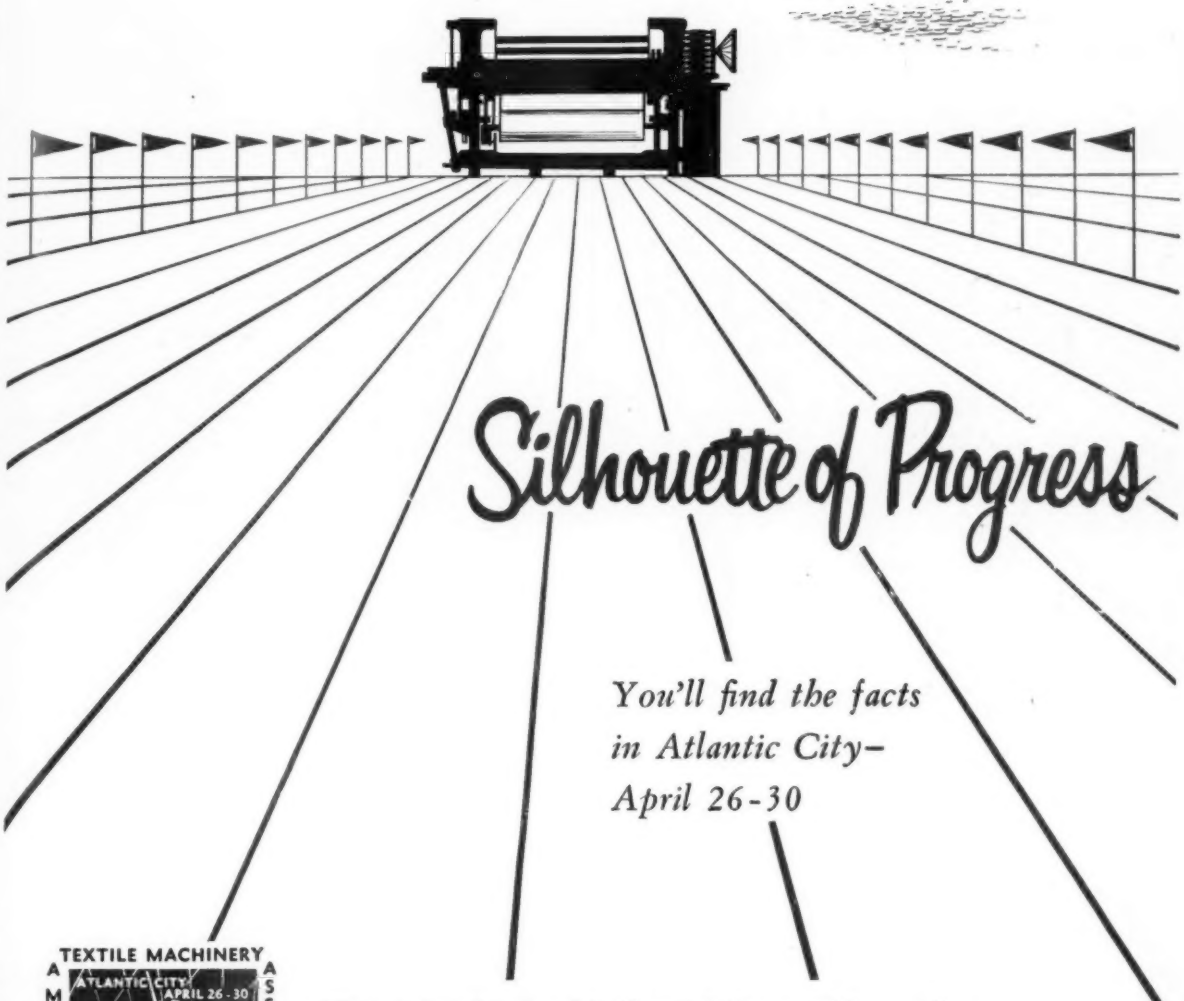

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